2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 Summary of Proposed Action

The Proposed Action is to approve, or approve with conditions, the SUPOs associated with drilling eight exploration gas wells for the purpose of gathering data on the extent and distribution of oil and gas resources on existing federal oil and gas leases, and test the wells for potential production. The Proposed Action includes defining Conditions of Approval for the surface use of the NFS and BLM Public Lands where drilling and road access is proposed. The Proposed Action for the USFS also includes granting exceptions to lease stipulations on federal oil and gas lease C-13563-A for the proposed locations of the Leon Lake #4 and #5 wells with respect to proximity to ponds, intermittent streams, and roads. The Proposed Action for the BLM also includes granting ROWs for road access to the Hubbard Creek, Oakbrush, Thompson Creek and Hawksnest wells sites. A ROW also is needed for the Thompson Creek well location itself.

Specifics regarding road access, drill pad design, and activities related to exploration drilling are discussed in Section 2.1.1. Design Features of the Proposed Action for protection of surface resources are discussed in Section 2.1.2.12.

2.1.1 Development of Proposed Action

The Proposed Action was developed through the NOS option of the APD process. This process is allowed under BLM's Onshore Oil and Gas Order No. 1 – Approval of Operations on Onshore Federal and Indian Oil and Gas Leases. This process sets up early involvement of the federal land management agencies, and provides for on-site reviews by federal agency Interdisciplinary Teams prior to an operator filing an APD. The BLM and USFS were involved in the process and provided input to the siting of proposed well locations that were carried forward in the Proposed Action.

The proposed well locations were sited to ensure compliance with surface use stipulations on the oil and gas leases, and through interdisciplinary review of proposed sites through the NOS process. Specific information on the lease stipulations is provided in Section 2.1.2.12.

GEC submitted NOSs on March 20, 2002, for six well sites in the Leon Lake (Gas) Unit (includes lease C-13563-A, and lease C-13509, and all or portions of Sections 12, 13, and 14, T12S, R94W) on the GMUG National Forests. The regulations call for the federal agencies to conduct on-site reviews within 15 days after receipt of an NOS. Due to winter conditions at the time of NOS filings, the field reviews were scheduled to occur when the sites would be accessible and visible. These six NOSs were for drill locations named the Leon Lake #1 through #6. The Leon Lake #1 and #2 were proposed on existing drill pads where shut in wells were present, and the Leon Lake #3 through #6 were proposed new wells. Onsite reviews were scheduled for June 4, 2002.

Because winter conditions precluded conducting onsite reviews at the time of the NOS filings, GEC elected to submit APDs for the Leon Lake #1 through #6 wells. The USFS received these APDs on April 5, 2002. GMUG review of the APDs found them to be incomplete, and they were returned to GEC for additional information.

Onsite reviews for the Leon Lake proposed wells #1 through #6 were held on June 4, and 5, 2002. In attendance from the USFS were geologists, a roads engineer, a wildlife biologist, silviculturist and a realty specialist. A BLM representative also was present. During these site visits, the USFS advised GEC to site their locations with respect for the lease stipulations.

Follow up onsite reviews were held on June 17 and 26, 2002, for the Leon Lake #3 through #6 locations. In attendance from the USFS were geologists, a wildlife biologist, and roads engineers. The locations had been revised by GEC with consideration for lease stipulations.

During the onsite reviews, the USFS team agreed with the proposed locations of the Leon Lake #1, #2, and #3 based on on-the-ground conditions that would minimize resource impacts. The team moved the proposed location of the Leon Lake #4 well to an area where surface use (related to range use) had previously occurred, drier conditions prevailed, and where minimal vegetation removal, and cut and fill would be needed. The team also relocated the proposed location of the Leon Lake #5 site to an area where drier conditions would prevail, cut and fill would be minimized, and length of the spur access road would be reduced. The USFS team slightly shifted the proposed location of the Leon Lake #6 site. The team recommended that this location be constructed to lie along the contour of the land surface to afford successful reclamation. The team brought forward concerns on the access road pertaining to areas of soil stability, stream crossings, and need for trail reroute.

Based on the onsite reviews, GEC was advised of the resource concerns raised by the USFS and BLM team for the proposed well locations. GEC elected to withdraw the APDs for the Leon Lake #1, #2, #3, and #6 (Sundry Notice dated October 2, 2002). GEC submitted APDs for the Leon Lake #4 and #5 on September 27, 2002. These were accepted as complete, and the SUPOs carried forward in this Proposed Action for environmental analysis.

The Leon Lake #4 site is proposed approximately 460 feet from the normal high-water-line of Surface Creek, and the Leon Lake #5 site is proposed approximately 97 feet from an intermittent stream. A stipulation on lease COC-13563-A requires drill sites to be located at least 500 feet from the high water levels of ponds and streams. The Leon Lake #5 is proposed approximately 330 feet from centerline of FR 127. A stipulation on lease COC-13563-A requires drill sites to be located at least 500 feet from the centerlines of an existing road. Exceptions to these lease stipulations are part of the Proposed Action.

NOSs were received for the for the Bull Park, Oakbrush, Hubbard Creek, and Powerline proposed wells on September 30, 2002. Onsite reviews for the Bull Park and Powerline locations were held on October 28, 2002. The Oakbrush and Hubbard Creek sites were visited on October 29, 2002. Federal agency specialists in attendance at these reviews were geologists, mineral specialists, range management specialists, roads engineers, wildlife biologists, and realty specialists.

The agency team relocated the proposed Bull Park site to afford better visual screening and site security. The team relocated the proposed Oakbrush site to avoid a surface drainage and identified the need for breeding bird surveys, archaeology and threatened and endangered species (TES) surveys. The team relocated the proposed location of the Hubbard Creek to avoid a surface drainage, and identified the need

for breeding bird, archaeological, and TES surveys. The team identified a concern for the proposed location of the Powerline well with respect to the Western Area Power Authority (WAPA) high-tension line, and identified the need for identified archaeological and TES survey information. WAPA responded that the existing location provided sufficient distance from the powerline for safety purposes.

Based on the onsite reviews, GEC was advised of the resource concerns raised by the GMUG and BLM team for the proposed well locations, and was advised of the need for engineering drawings of the proposed new spur road construction. GEC submitted APDs for the Bull Park, Oakbrush, Hubbard Creek, and Powerline proposed wells, which were received by the agencies on December 11, 2002. These were accepted as complete, and the SUPOs carried forward in this Proposed Action for environmental analysis.

The Powerline, Bull Park, Hubbard Park, and Oakbrush sites are proposed within areas defined with a controlled surface use (CSU) lease stipulation for moderate geologic hazards. This stipulation requires that special interdisciplinary team review occur at the time activities are proposed in order to assure that adequate mitigations are in place if necessary.

NOSs for the Thompson Creek and Hawksnest sites were received on September 30, 2002. Onsite reviews for these locations were held on November 5, 2002. Federal agency specialists in attendance at these onsite reviews included a geologist, wildlife biologist, and realty specialist. The agency team agreed with the proposed location of the Hawsknest well. The team relocated the Thompson Creek location to a more level location to minimize cut and fill. GEC was advised of these and other information needs, including the needs for ROWs for off lease road access and the pad location of the Thompson Creek site. APDs for these locations were received on December 11, 2002. The SUPOs were carried forward in this Proposed Action along with the proposals for the needed ROWs for environmental analysis.

A seasonal stipulation in the BLM RMP is in effect for the area where the Thompson Creek and Hawksnest wells are proposed. This stipulation limits seismic and drilling activities from December 1 to April 30 within crucial deer and elk winter range and bald eagle foraging habitat. The RMP also contains direction for this area for protecting riparian and aquatic systems by providing a 0.25-mile buffer. Variances to these stipulations may be granted on specific cases. The proposed well locations do not fall in the specific area designated for this habitat. Variances to these stipulations are not part of the Proposed Action.

2.1.2 Description of Proposed Activities

2.1.2.1 Construction and Site Layout

Well Pad Design and Construction

Eight well pads would be constructed as part of the exploratory drilling project. The locations of the proposed well pad sites are shown in **Figure 1-1**. Legal descriptions are listed in **Table 2-1**. A detailed location map for the well sites and access roads is provided in Appendix B, **Figures B-1** through **B-8**. The size of a typical well pad during drilling would be 225 feet by 150 feet (0.77 acre). A typical drill pad layout is shown in **Figure 2-1**. An additional buffer zone of approximately 0.37 acre per pad would be required for an

equipment turn-around area and material storage (i.e., topsoil and brush). The estimated disturbance areas associated with the well pad sites and access roads are listed in **Table 2-2**.

Table 2-1
Location and Surface Management of the Well Sites

Well Name	Location (Township, Range, Section, and ¼-¼ Section)	Management
Bull Park	T12S, R91W, Section 31, NENE	USFS
Hawksnest[1]	T13S, R90W, Section 2, SENW	BLM
Hubbard Creek	T12S, R91W, Section 23, SWSE	USFS
Leon Lake #4	T12S, R94W, Section 13, SENE	USFS
Leon Lake #5	T12S, R94W, Section 13, SESW	USFS
Oakbrush	T12S, R91W, Section 26, NESE	USFS
Powerline	T12S, R91W, Section 17, SESW	USFS
Thompson Creek	T13S, R90W, Section 2, NENE (Bore hole) T12S, 90W, Section 35, SWSE (Directional drill location)	BLM

[1]A variance would be needed for the set back from the lease line.

Table 2-2
Estimated Disturbance for the Exploratory Drilling Project

	Road	Disturbance (Feet[2])				Disturbance (Acres)			
Well Pad Site	Length (Feet)	New Road[1]	Existing Road	Pad & Buffer	Total	New Road	Existing Road	Pad & Buffer	Total
Bull Park	945	28,350	0	49,658	78,008	0.65	0	1.14	1.79
Hawksnest	70	2,100	82,200[2]	49,658	133,958	0.05	1.89	1.14	3.08
Hubbard Creek	4,560	136,800	0	49,658	186,458	3.14	0	1.14	4.28
Leon Lake #4	1,710	51,300	0	49,658	100,958	1.18	0	1.14	2.32
Leon Lake #5	330	9,900	0	49,658	59,558	0.23	0	1.14	1.37
Oakbrush	1,935	58,050	0	49,658	107,708	1.33	0	1.14	2.47
Powerline	75	2,250	124,500[3]	49,658	176,408	0.05	2.86	1.14	4.05
Thompson Creek	35	1,050	414,750[4]	49,658	465,458	0.02	9.52	1.14	10.68
Pilot Knob/Coal Gulch all-terrain vehicle (ATV) Trail[5]	375	3,750	0	0	3,750	0.09	0	0	0.09
Total	**10,035**	**293,550**	**621,450**	**397,264**	**1,312,264**	**6.74**	**14.27**	**9.12**	**30.13**

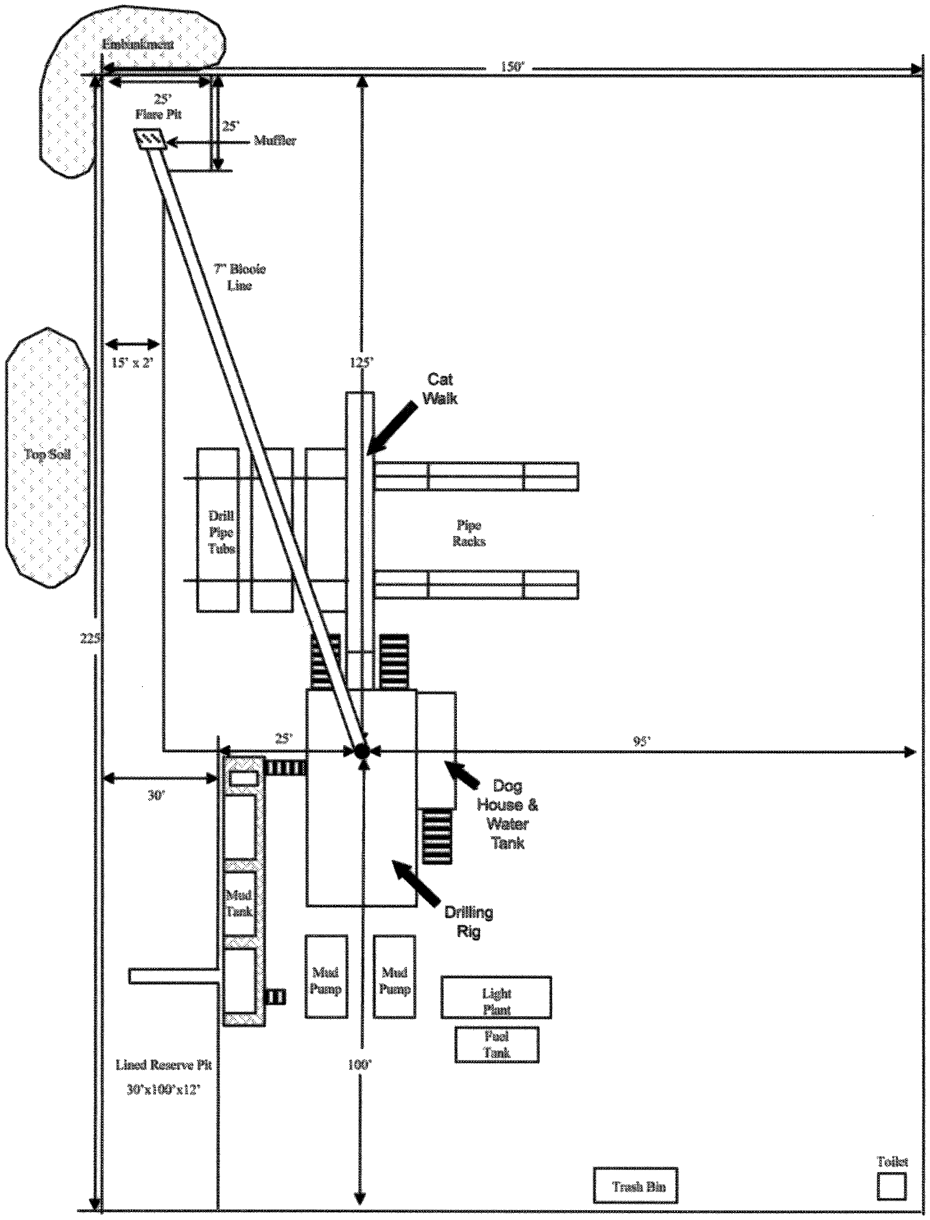
[1]Assumes a road width of 30 feet.

[2]Upgrade on Coal Gulch Jeep Trail Road (2,740 feet x 30 feet).

[3]Upgrade on Western Area Power Authority (WAPA) maintenance road (4,150 feet x 30 feet).

[4]Upgrade on Coal Gulch Jeep Trail Road (13,825 feet x 30 feet).

[5]Reroute (375 feet x 10 feet) adjacent to the Thompson Creek well pad.



Total Acres = 0.77

Natural Gas Exploratory Drilling Project

Figure 2-1

Typical Drill Pad Layout for Drilling Operations

Construction of the well pads would follow procedures described in the APD for each site. Well pad construction would require approximately 2 to 3 days. Well pads would be cleared of vegetation, and topsoil (up to 6 to 8 inches where available) would be removed and stockpiled (uncovered) as shown in the site layout (**Figure 2-1**). Detailed grading and drainage drawings are provided in the APD for each site. Grading of the well site would include the area where the drilling rig and ancillary facilities are positioned. Prior to initiating construction, a contour trench or trenches and sediment traps would be constructed to divert water runoff away from the pad. Certified weed-free straw bales and silt fences would be used to stop soil transport in the ditches and along other natural drainages. Any excess rock turned up during grading would be buried in the fill side of the location or disposed of as specified by the USFS or BLM. Any removed brush would be distributed at slope toes for water-runoff dispersion. A Timber Contract would be obtained from the USFS before removing any merchantable timber from the well pad area and access road. The well pad would be leveled using standard cut-and-fill construction techniques using a crawler tractor with blade.

A dry hole digger would be used for placing a "conductor pipe." A 16-inch-diameter vertical conductor pipe would be forced 40 feet down into the ground and cemented in place to stabilize the surrounding surface around the future wellbore. A 6-foot-diameter cellar box similar to a culvert made of galvanized steel would be constructed in the ground horizontally around the conductor pipe to surface level. This keeps surface sand and dirt from falling into the wellbore and protects the integrity of the wellbore at the surface. Drilling operations would be conducted (downhole) inside the pipe. The pad area would be graded and ditched to drain into a shallow basin. After construction is completed, the site would be fenced (6 feet in height) on all sides along the perimeter of the disturbed area. Corner braces would be H-type construction.

A reserve pit (approximately 30 feet by 100 feet by 12 feet deep) would be excavated within the pad's perimeter to catch the drill cuttings (dirt and rock from drilling) and fluids. It would be lined with impervious heavy plastic material (i.e., man-made synthetic) with a permeability of 1×10^{-7} centimeter per second. The liner would be chemically compatible with all substances that might be stored in the pit. The reserve pit would be fenced stock-tight on three sides during drilling operations. The fourth side would be fenced after the drilling rig is removed from the site.

Noxious weeds would be controlled on all disturbed areas as directed by the USFS and BLM and as indicated in the approved Noxious Weed Plan. Weed control may include an approved mechanical removal or a spraying with U.S. Environmental Protection Agency (USEPA)-registered herbicide. The USFS or BLM must approve all herbicide applications prior to use. Herbicide application must be done by a Colorado-licensed operator.

Prior to beginning construction of the wells, a pre-work conference would be held with the USFS and BLM representatives, earth-work contractor, and the GEC compliance officer to review plans, specifications, requirements, and the chain of command.

Proposed Road Use and Spur Road Construction

Well sites would be accessed using a combination of existing roads and newly constructed spur roads. Under a Forest Supervisor's order and applicable laws, the operator would be required to obtain a USFS Road Use Permit prior to using a USFS road for exploration activities. BLM ROWs would be required for

use of off-lease roads. The primary roads that would be used to access the general area include State Highways (SHs) 65 and 133. The following access roads would be used for each well site (see **Figure 1-1** and Appendix B, **Figures B-1** through **B-10**):

- Leon Lake #4 – SH 65, CR U50, 2500 Drive (DR), FR 125, FR 127, and a new 1,710-foot road spur on NFS lands.;

- Leon Lake #5 – SH 65, CR U50, 2500 DR, FR 125, FR 127, and a new 330-foot road spur on NFS lands;

- Powerline – SH 133, Stevens Gulch Road (FR 701), upgrade and maintenance on existing road for the WAPA Overhead Powerline, and a new 75-foot road spur on NFS lands;

- Bull Park – SH 133, Stevens Gulch Road (FR 701), and a new 945-foot road spur on NFS lands;

- Hubbard Creek – SH 133, Bear Creek Road, and a new 4,560-foot road spur on NFS lands. Approximately 4,220 feet (0.8 mile) on Bear Creek Road would be off-lease ROW on BLM lands (Appendix B, **Figure B-9**);

- Oakbrush 12-91 #1-26 – SH 133, Bear Creek Road, and a new 1,935-foot road spur on NFS lands. Approximately 4,220 feet (0.8 mile) on Bear Creek Road would be off-lease ROW on BLM lands (Appendix B, **Figure B-9**);

- Hawksnest – SH 133, Coal Gulch Jeep Trail, and a new 70-foot road spur on BLM lands. Approximately 2,740 feet (0.5 mile) would be off-lease ROW (Appendix B, **Figure B-10**); and

- Thompson Creek – SH 133, Coal Gulch Jeep Trail, and a new 35-foot road spur on BLM lands. Approximately 13,825 feet (2.6 miles) would be off-lease ROW (Appendix B, **Figure B-10**).

Road construction would consist of 1.83 miles (6.74 acres) of new roads for the eight well sites. The estimated disturbance for access road construction and the well pads is provided in **Table 2-2**. The new road construction segments are shown in Appendix B, **Figures B-1** through **B-8**. Approximately two or three people would perform the road construction work. It is estimated that new road construction would require 2 to 7 days per site, depending on the length of new road. Upgrade construction would be needed for two existing roads, Coal Gulch Jeep Trail and the WAPA road. The estimated disturbance would include the following:

- WAPA Maintenance Road (NFS land) – The length used would be approximately 4,150 feet long and 30 feet wide (2.9 acres).

- Coal Gulch Jeep Trail (private and BLM land) – The ROW on this road would be 2,740 feet and 30 feet wide (1.9 acres) for the Hawksnest well site and 13,825 feet and 30 feet wide (9.5 acres) for the Thompson Creek well site.

- Bear Creek Road (private and BLM land) – The ROW across BLM off-lease would be 0.8 mile. No new upgrade work (i.e., widening or culvert installation) would be required for this road.

Plans for upgrading the WAPA maintenance road and the Coal Gulch Jeep Trail would be submitted to the USFS and BLM, respectively. The width of these roads would be maintained, as they presently exist unless authority to widen is granted to the operator by the District Ranger or BLM representative. The roads would be maintained reasonably smooth, free of ruts, soft spots, chuckholes, rocks, slides, and washboards. Maintenance for the Coal Gulch Jeep Trail would include blading, ditching, sign replacement, surfacing, and culvert maintenance as agreed to with Oxbow and consistent with mining or any other applicable regulatory requirements.

Detailed engineering design information is provided in the Engineered Road Plan prepared by a licensed professional engineer for each well pad site. The final road improvement plan, addressing subjects including alignment, sizing and location of culverts, road surfaces and design shall be reviewed and approved by the USFS or BLM. Construction and ground disturbance shall commence only following authorization from the agencies. The subgrade (running surface) of each access road would be 14 feet, with a total width of 30 feet to allow for vehicle turnouts. Brush vegetation would be removed with a brush cutter. The maximum grades for the roads are listed in **Table 2-3**.

Table 2-3
Maximum Grade Requirements and Road Segment Gradient Length for the Access Roads

Well Pad Site	Grade (percent)	Road Segment Gradient Length (feet)
Leon Lake #4	12	300
Leon Lake #5	8	75
Powerline	2	75
Bull Park	12	300
Hubbard Creek	12	300
Oakbrush	12	300
Thompson Creek	1	35
Hawksnest	<2	70

The roads would be designed to allow drainage runoff in a manner that would minimize erosion. Drainage would consist of borrow ditches on both sides of the road, which would be constructed prior to commencement of drilling operations. Wing ditches and water dips would be placed at 250- to 500-foot intervals as necessary for erosion control. Appropriate water bars also may be constructed to ensure drainage to conform to natural drainage patterns at each site. On side hills, the road would be sloped inward toward the high side of the hill and a borrow ditch would be placed at the upslope side. Borrow ditches would be backsloped at a maximum ratio of 2 horizontal:1 vertical. No borrow ditches would be constructed on the downhill side of the road.

Soil removed during road construction would be stockpiled at approved locations for use in reclamation. Topsoil would be separated from subsoil and signs would identify each stockpile. No soil removed during excavation would be deposited in a drainage with flowing water. Surface material for the road would consist

of material approved by the USFS and BLM. If road rutting deeper than 2 inches occurs, project-related use of the road causing ruts would cease until repairs are completed. Surface hardener (geotextile fabric) applied in combination with crushed rock aggregate would be used after direction and/or approval by the appropriate USFS or BLM official. After the road is completed, the margins of road disturbance width would be reseeded as soon as possible during the appropriate time of year. If a well is determined to be unproductive, the entire road width would be reclaimed as soon as practical using stockpiled topsoil and appropriate seeding techniques, as described in Section 2.1.2.11.

Fence cuts and cattle guards would be installed at road intersections to the wells. A 14-foot security gate with a sign indicating well name and number, lease number, operator, and well location would be installed at the beginning of each new spur access road. The gate would be locked at all times to prevent general use of the road.

Specific measures would be followed during use of existing access roads to maintain their condition at good or better levels than presently exist. These would include:

- The present road width would be maintained, unless a request is made and approved by the BLM or USFS for widening.

- Operations would cease during periods when silt and mud cannot be contained within the road prism or construction specifications cannot be achieved due to wet or frozen soil conditions.

- Mud blading would not be allowed.

- Dust control materials such as water sprays and non-toxic dust control materials (e.g., magnesium chloride) would be used. Magnesium chloride would be applied to unpaved CRs (approximately 10 trucks per mile for 8 miles). Water would be used on new spur roads (see Section 2.1.2.5).

- GEC traffic would observe winter road closures, using snowmobile(s) for any maintenance activities during the winter.

- GEC would be responsible for appropriate speed control devices when heavy equipment is moved on USFS or BLM roads.

- Best Management Practices (BMPs) would be applied to all construction activities.

- New spur access roads would be closed to public motorized use during project operations by using locked gates and signs. Signs and gates for the roads would be provided and installed by GEC at locations designated by the USFS and BLM.

- In the event that snow removal is needed for emergency access to the wells sites, and after notifying the appropriate USFS or BLM official, snow removal would be done in a manner to preserve and protect

the roads to the extent necessary to ensure safe travel and to prevent excessive damage to streams, adjacent lands, and vegetation.

- Drilling equipment would not be moved to and from the well pad sites during spring thaw.

- Maintenance activities would be performed by GEC, as directed by the USFS or BLM official in compliance with their Road Use Permit or ROW agreement. Maintenance would consist of repair and protection of the roadbed, surface, and all structures and appurtenances (i.e., inspection, clean out, and repair of drainage structures).

Staging Area

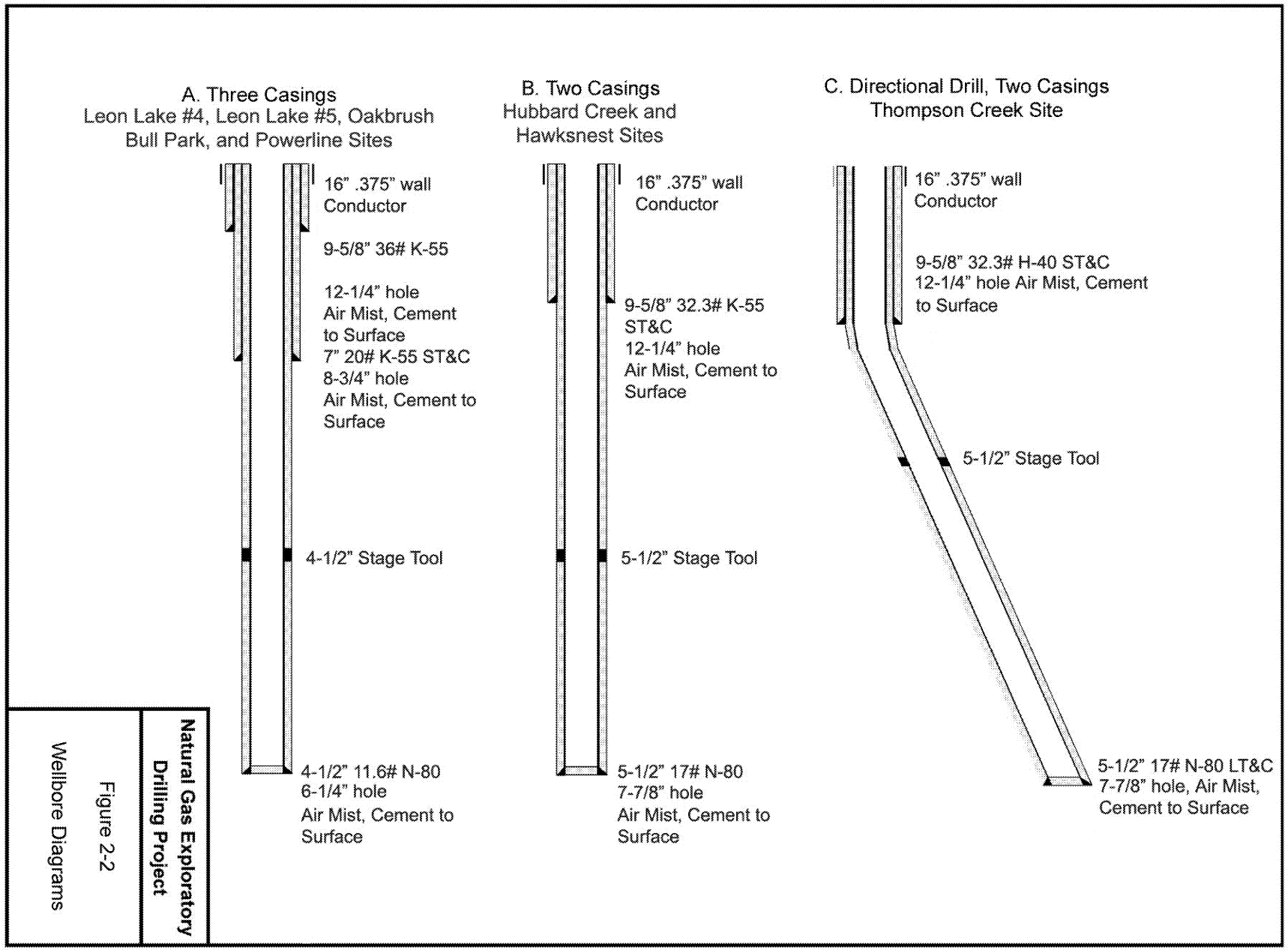
There would be no staging area associated with the drilling or completion of the eight exploratory wells. There may be times when crews would have to wait for traffic to abate before accessing the well site.

2.1.2.2 Drilling Operations

After the well site is constructed, a trailer-mounted drilling rig would be erected on the location. The height of the rig would be approximately 95 feet (see **Figure 2-3**). The rig would be self-contained using generators to produce electricity for 24-hour operation. Equipment placement within the pad site is shown in **Figure 2-1**. Ten to 12 truckloads would be required to transport the drilling rig and associated equipment to the site. Heavy equipment at the site would include the rig, catwalk, fuel tank, collars/pipe racks, pipe baskets, mud tank shale shaker, triplex pump, duplex pump, water tank, junk basket, and choke manifold. A 400-barrel (16,800-gallon) water tank would be placed on location for the purpose of fire control. A typical well can take 6 to 10 days to complete the drilling operations. Two to three temporary trailers also would be used on the well site during drilling and completion operations.

Typically, approximately 10 workers (2 shifts of a 5-person crew) would be at the well site, 24 hours a day, 7 days a week, during drilling operations. There could be up to 20 people onsite during casing and cementing operations. Due to the site elevations and lease stipulations, drilling and completion operations would be carried out during the months of April through December, or longer if weather permits. If the wells require attention during the winter months, they would be accessed via the use of snowcats, snowmobiles, ATVs, skis, or snowshoes. All heavy maintenance would take place during the months of April through December.

The wells are expected to be 2,500 to 5,000 feet in total depth. Two wellbore designs would be used to drill the wells. The presence and depth of the Wasatch Formation would determine which well design would be used at each drill site. If the thickness of the Wasatch Formation is greater than 700 feet, the well would require surface, intermediate, and production steel casings (**Figure 2-2[A]**). If the Wasatch thickness is less the 700 feet, only surface and production steel casings would be required (**Figure 2-2[B]**). Each group of casings would be encased in cement from total depth to the surface. The well control system would be designed in accordance with Federal Onshore Order #2. The Thompson Creek would be directionally drilled. **Figure 2-2[C]** shows surface and production steel casing used in directional drilling.



Natural Gas Exploratory Drilling Project

Figure 2-2

Wellbore Diagrams

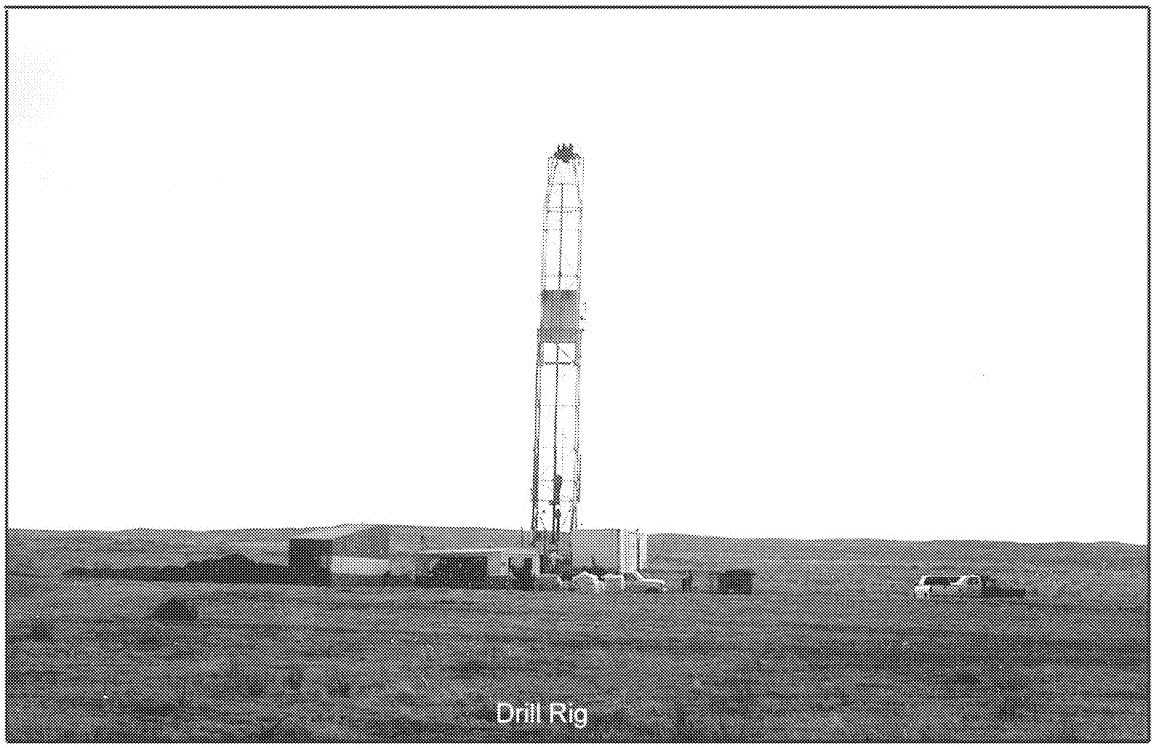


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Figure 2-3

Example of Drill Rig and Completion Rig

It is anticipated that the wells can be drilled entirely with compressed air to circulate the drill cuttings out of each hole. If air drilled, each well would require water for cementing and stimulation. The water would be trucked to the location from the Oxbow Mine located near Somerset, Colorado. Additional information on water use is described in Section 2.1.2.5.

Air serves some of the same purposes as drilling mud (i.e., cooling and cleaning the bit and evacuating drill cuttings from the hole). Drilling with air generally increases the rate of bit penetration. However, air drilling is applicable only where little water is encountered in the subsurface and where the pressures of the formations to be penetrated are well known. Air is ineffective in controlling high formation pressures or building mudcake and maintaining the integrity of the sidewalls of the hole. If the well can not be drilled with air, a simple mud system consisting of bentonite and native mud would be used. Some polymers and salts would be added, as needed, to clean the hole and stabilize shale formations. Drilling chemicals are listed in Appendix C, **Table C-1**. If mud is required, approximately 5,400 barrels (226,800 gallons) of water would be used. Up to 25 percent of the water may be recycled and used for completion operations or for drilling another well.

A directionally drilled well would be used for the Thompson Creek site. This method typically involves running mud motors and steering equipment in the well bore while drilling the well. This equipment is used to "steer" the well bore in the desired direction, and ultimately into the predetermined bottomhole (target) for the drilling operation.

Casing would be run to the producing zone, and the annulus between the casing and the hole would be filled with cement from total depth to the surface. The formation could fracture from the hydrostatic pressure (weight of the column of cement between the steel casing and the hole) so the primary cement job would be completed in two separate stages. The bottom stage would be pumped first and allowed to harden before the second stage would be pumped. Proper cementing of any casing would be required to prevent interzonal communication between gas horizons and usable water zones. Fresh water would be used in mixing cement to ensure the quality of the slurry.

Turbulent centralizers would be placed around the outside of the casing to keep it in the center of the hole. When the casing is cemented, the cement slurry would be swirled around the casing by the centralizer to evenly distribute the cement around the outside of the casing. This would ensure that the cement would completely fill the annular space and would preclude interzonal migration of formation fluids (i.e., groundwater). In addition, the cement would protect the well by preventing formation pressure from damaging the casing, and it would retard corrosion by minimizing contact between the casing and formation fluids.

In order to ensure isolation and protection of all zones between the surface and total depth, the BLM and the State of Colorado require that all hydrocarbon and water-bearing zones be isolated from each other with cement. COGCC Rule 317-h states that "The operator shall ensure that all surface and intermediate casing cement required under this rule shall be of adequate quality to achieve a minimum compressive strength of three hundred (300) pounds per square inch (psi) after twenty-four (24) hours and eight hundred (800) psi after seventy-two (72) hours measured at ninety-five degrees Fahrenheit (95°F) and at eight hundred (800) psi." The applicable BLM regulation is Onshore Oil and Gas Order No. 2.

2.1.2.3 Completion Operations

When the drilling rig is removed from the well site location, the following activities would occur simultaneously: 1) the fourth side of the reserve pit would be fenced, 2) the well site location would be leveled, and 3) the reclamation process would begin. A completion rig (approximately 90 feet in height) then would be moved onto the well site location and erected. An example of this type of rig is shown in **Figure 2-3**. A typical completion pad layout is shown in **Figure 2-4**. Heavy equipment associated with the rig setup would include the rig, catwalk, mud tank shale shaker, triplex pump, and the blowout preventer and closing unit.

The well casing would be tested to ensure sufficient strength prior to proceeding with the completion. A wireline unit then would be rigged up on the well and a cement bond log would be run to verify the cement integrity behind the steel casing. Additional cementing may be required at this stage to improve integrity and zonal isolation.

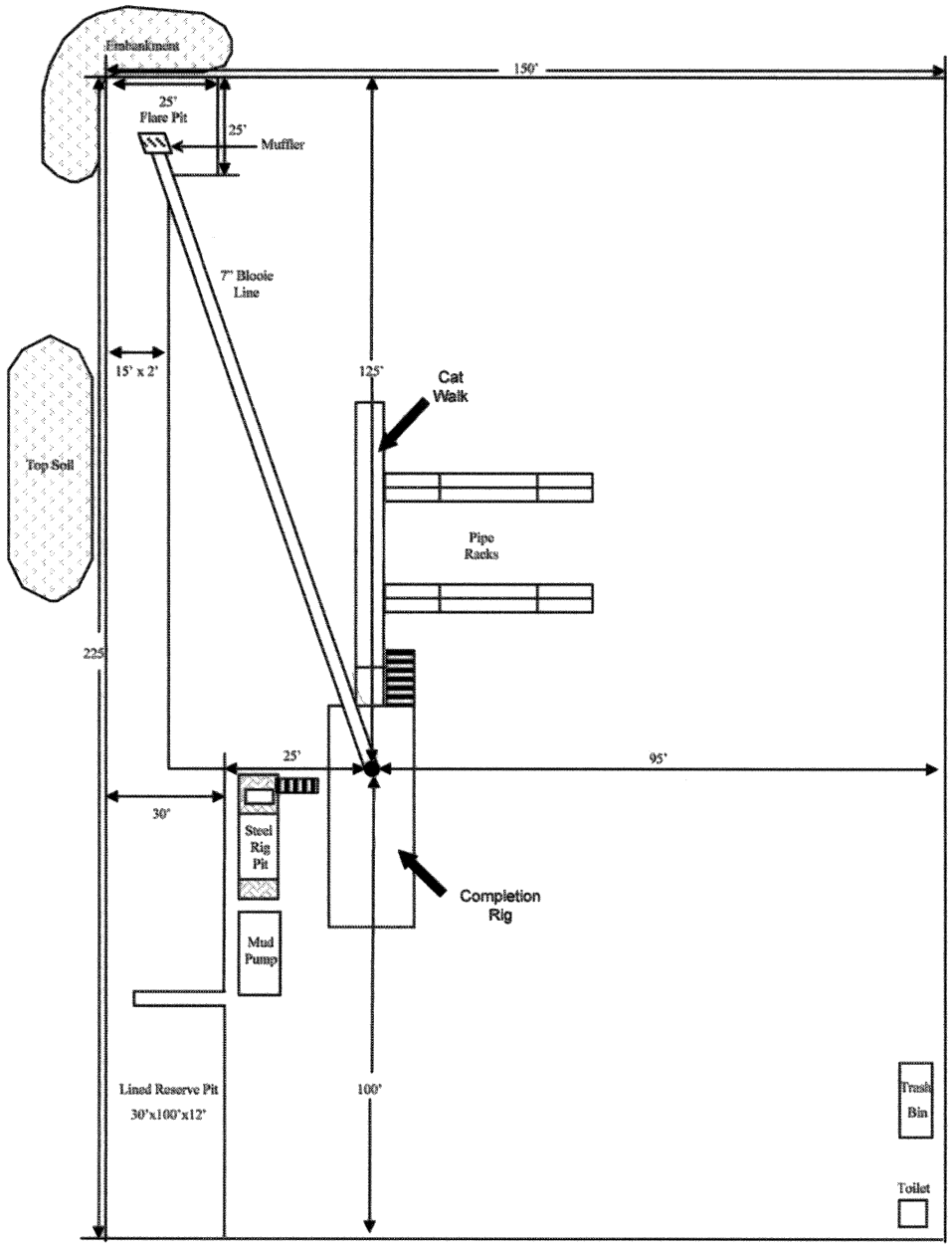
The target formation for natural gas production is the Mesaverde. There are five zones of potential gas production within the Mesaverde Formation under the south flank of the Grand Mesa. The proposed wells would be drilled through the entire Mesaverde layer and reach total depth within the Mancos Formation. Well logs would be run in each well to evaluate the formations for potential gas productivity. This process provides measurements of various rock properties such as natural occurring radioactivity of the formation, rock density, rock porosity, and the electrical conductivity of the rock using measurement tools. **Figure 2-5** identifies the zones that would be explored for potential natural gas. The zones with the most promise would be hydraulically stimulated. If the wells prove to be uneconomical,[1] they would be plugged according to state and federal regulations, and the well site would be reclaimed.

Hydraulic Stimulation (Fracing)

Hydraulic stimulation (also called hydraulic fracturing or "fracing") is a technique used to facilitate the movement of oil and natural gas from the rock pores in a well. The technology was developed in the late 1940s and continuously has been improved and applied since that time. Many wells do not produce gas until after they are stimulated in this fashion. The productivity of the well greatly increases as the effective area of the wellbore is expanded. The stimulation results in a fractured area that is connected to the wellbore. This fractured area increases the effectiveness of the wellbore allowing the well to produce as if the wellbore diameter was larger than its actual size.

Hydraulic fracturing is used to create small cracks in subsurface geologic formations. An operator pumps a water-based fluid into the formation, and as the pumping rate is gradually increased, the rock fractures at an approximate width of 0.25- to 0.5-inch. The created fractures would be vertical and typically extend 250 to 500 feet radially from the well bore. This would result in a total fracture length of 500 to 1,000 feet. Hydraulic stimulation could potentially be used throughout the Mesaverde Formation layers including (top to bottom)

[1] According to 43 CFR 3160, a well would be considered a "paying well" if it is capable of producing oil and gas of sufficient value to exceed direct operating costs and the costs of lease rentals or minimum royalty.



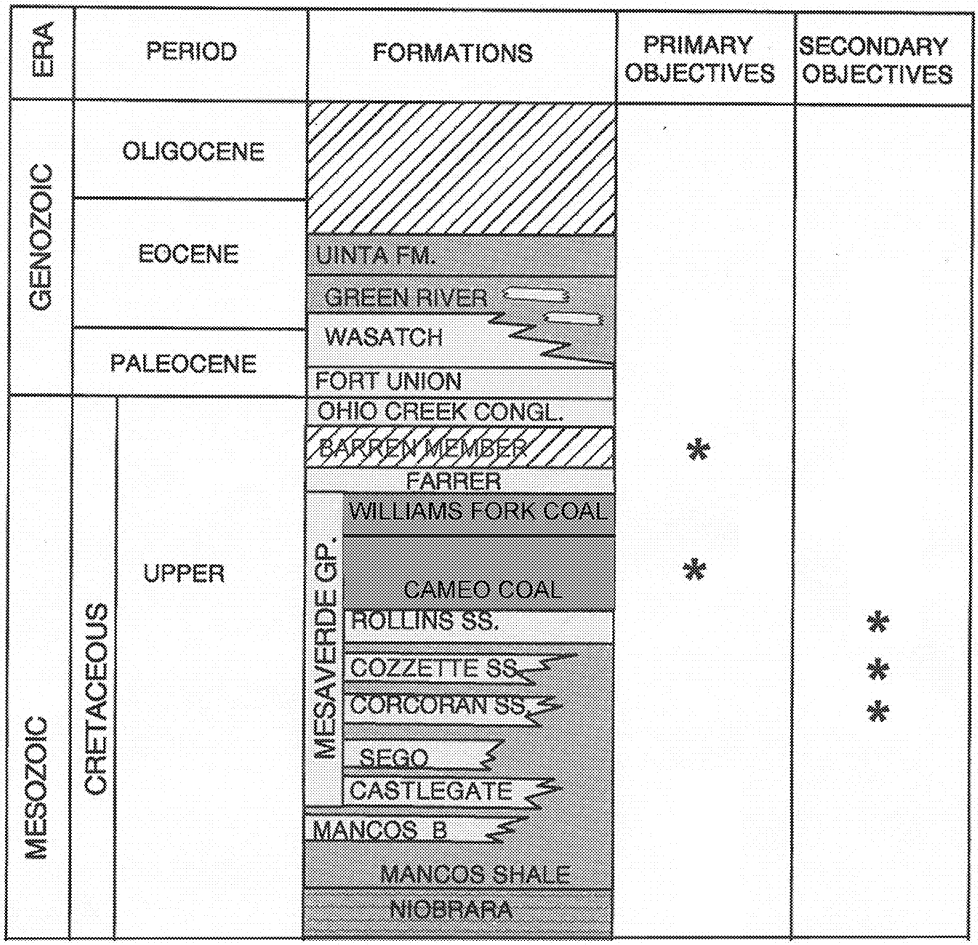
Total Acres = 0.77

Natural Gas Exploratory Drilling Project

Figure 2-4

Typical Completion Pad Layout

Piceance Basin
Stratigraphic Chart



Sand

Shale

Coal

* Indicates Formation To Be Drilled For Natural Gas

Primary Objectives = Primary Target Zones
Secondary Objectives = Secondary Target Zones

Natural Gas Exploratory Drilling Project

Figure 2-5

Zones to be Explored for Natural Gas

the lower part of the Barren Member, throughout the Coal Bearing Member, the Rollins, and the Corcoran and Cozzette members (where they exist below a tongue of the Mancos Shale). If only fluid was being pumped into the well, the fracture would close when the operator stopped pumping, and within minutes the formation would be back to its original non-fractured state. To prevent a fracture from healing, sand (called proppant) is pumped into the fracture to keep it propped open. Even though the fracture is full of proppant, it still has more porosity and permeability than the formation itself.

A fluid consisting of sand, water, and some chemical agents such as guargum to carry the sand would be injected under pressure. Chemicals and materials used in the completion process are listed in Appendix C, **Table C-1**. The fracture would begin at the well bore and extend out in two separate wings and in opposite directions.

The extent of the fracture is controlled by the characteristics of the geologic formation, depth, fluid type, and pumping pressure. The fracture would grow if the operator continues to pump fluid at higher rates, or if the operator pumps a more viscous fluid into the formation (i.e., guargum = high viscosity, water = low viscosity). Whether the fracture grows higher or longer is determined by the surrounding rock properties and treatment pumping pressures. Often shale beds are found above and below coal strata. When the fracture reaches the shale it would stop as shale does not fracture as easily as coal. As a result, the treatment would follow the path of least resistance and stay within the formation that fractures easiest.

After the operator has completed the fracture job, the viscous fracturing fluid would be removed from the rock so that the oil or gas molecules can move easily through the fracture. Fracture fluids are designed to "break down" after the job has been completed. Typically, the fluid would break down until it has the relative consistency of water. Being a thin fluid like water, it can easily pass through the propped fracture into the wellbore for pumping to the surface. It is estimated that 30 percent of the fracturing fluids would be left in the fractures.

At this time, it is unknown how many productive zones (gas) might be present for each well. Exploratory wells must be drilled and tested to determine which area or areas would yield commercial production. From the limited amount of data that are available from the coal mine exploration wellbores and the few gas wells drilled in the 1980s, it is possible to have up to eight productive zones, or as few as one or two productive zones, in each well. Each zone would be tested to determine if it would be economically reasonable to fracture that zone. It is anticipated that there typically would be one or two hydraulic stimulations per well. Typically, it is possible that there could be as many as six to eight hydraulic stimulations in each well.

2.1.2.4 Testing

Well tests would be conducted to determine the formation productivity. Tests can either be conducted open-hole (while the well is being drilled) or cased-hole (after the casing is cemented and perforated and the well is hydraulically fractured). Overall, testing could take from approximately 5 to 120 days. Decisions made on the various steps in the formation evaluation process are shown in **Figure 2-6**. The following information describes the various testing procedures.

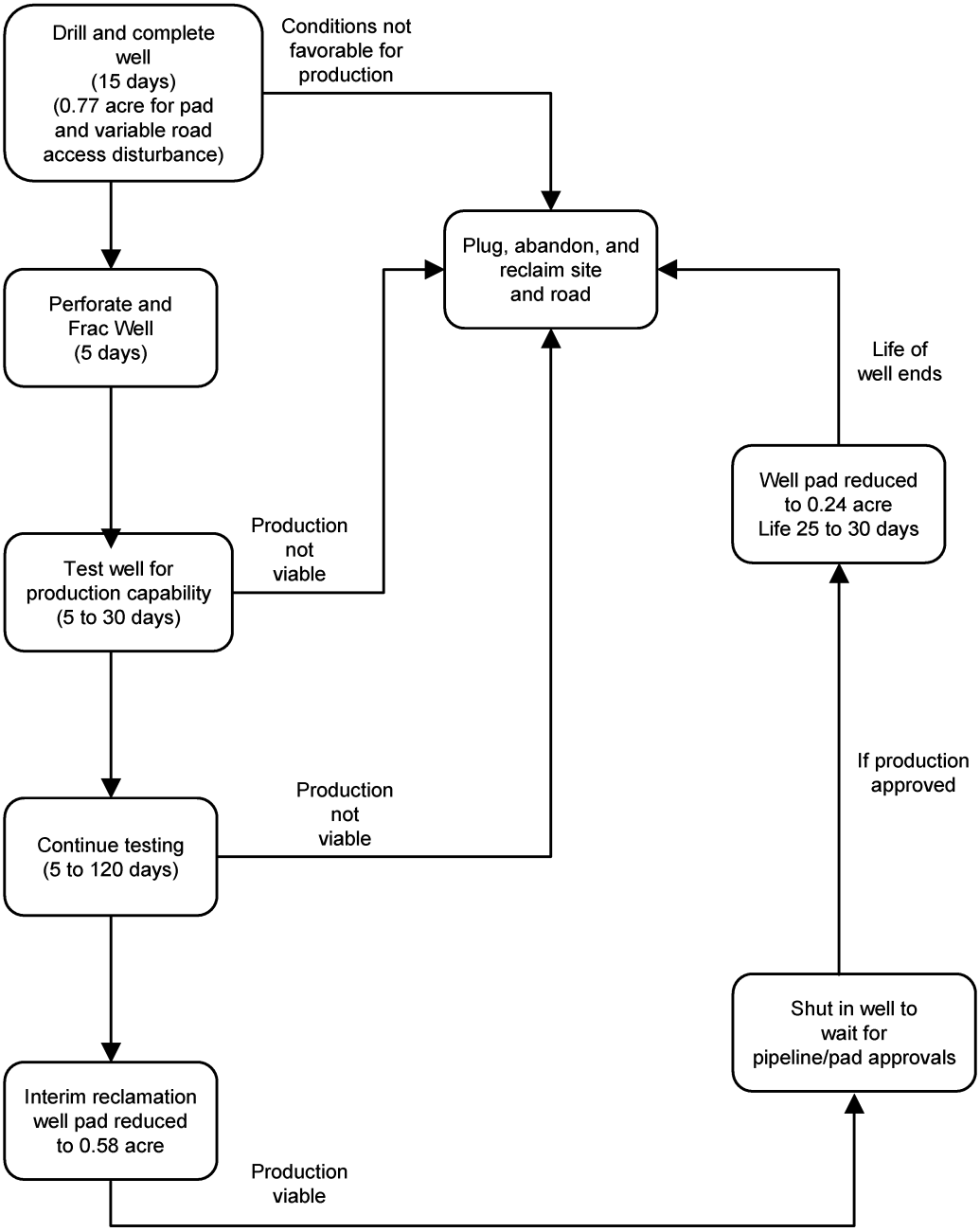


Figure 2-6. Well Completion and Testing Flow Chart

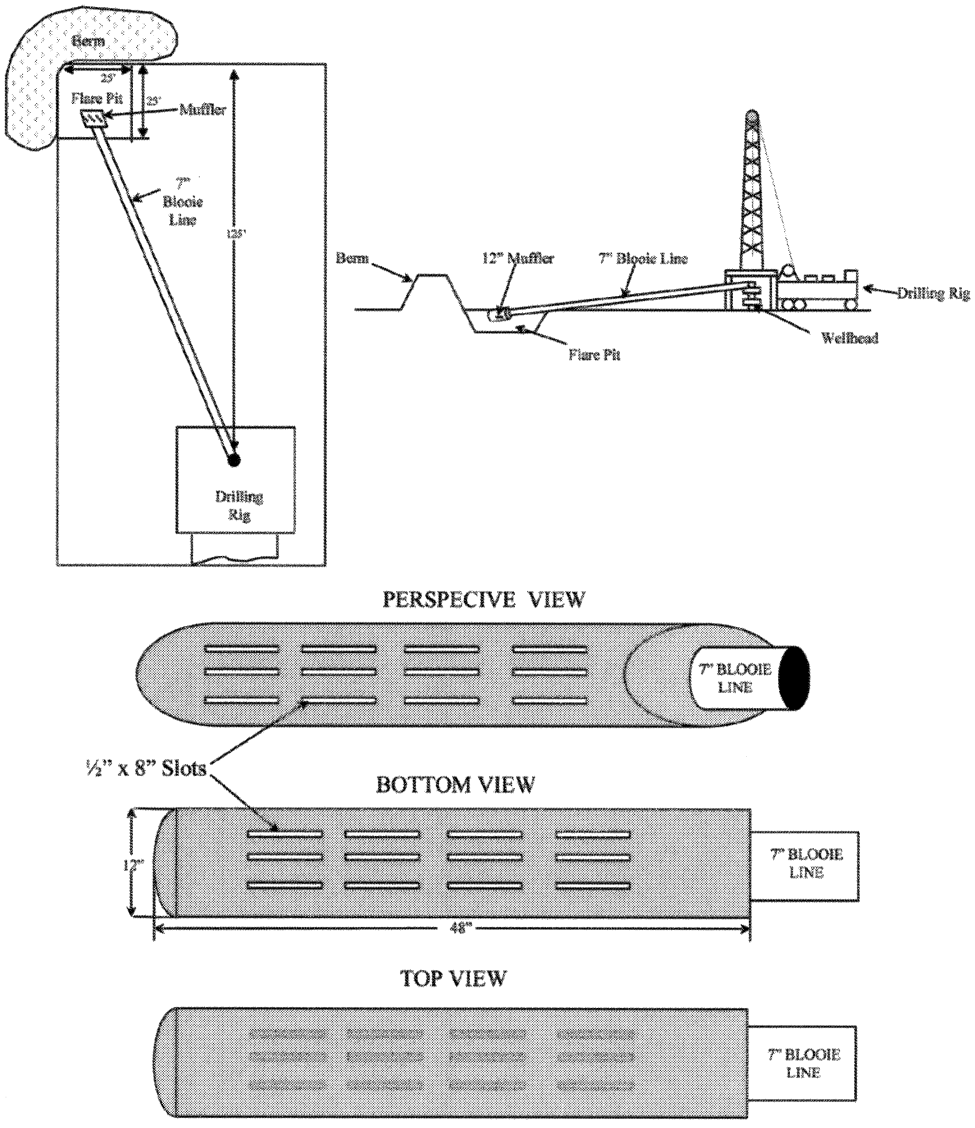
The wells would be drilled with air (or drilling mud as a secondary option) as a circulating fluid. During drilling a 7-inch (diameter) pipe (called a Blooie line or closed flaring system) would be run from the wellhead to the flare pit. The line would be aimed downward and essentially be on the ground as it crosses the flare pit perimeter. A muffler (10-inch-diameter) would be installed on the end of the line to dissipate the air return (**Figure 2-7**). If gas is circulated to the surface during drilling or the initial completion, it would be flared in the pit. There would be a 6- to 8-foot earthen berm surrounding the flare pit that would contain any flaring that takes place (see drill pad layout in **Figure 2-1**). This flare would be short-term in duration (2 to 3 days) and approximately 6 feet tall. It would be marginally visible due to screening by the rig structure and earthen berm surrounding the pit.

After penetrating a potential productive zone, the formations would be tested. This would determine if expensive completion procedures would be used. The first evaluation is normally completed by logging the open hole of the well. Drill stem tests (DSTs) are sometimes run on intervals to evaluate important gas reservoir characteristics such as permeability, pressures, and fluid properties. Any production from an oil or gas or water-bearing formation would flow to the surface, with the air, where samples would be collected for analysis.

A surface test tree consisting of several control valves would be attached to the top of the drill pipe for the DST. A flowline would be extended from the test tree through a choke assembly to a flare pit away from the hole in order to burn any gas that may come to the surface. A berm usually is constructed around the pit to contain the flare and any materials such as cuttings or fluid, which might be blown out with the gas stream. Using these data and the evaluations of engineers and geologists, a decision would be made to complete the hole for potential future production of oil or gas or proceed with abandonment according to state and federal standards.

After the initial completion, the rig would be moved off the location and well test equipment would be installed. A typical well test layout is shown in **Figure 2-8**. The fluids and liquids from the well would flow to the surface and be directed through a test unit where the water and/or liquid hydrocarbons would be separated from the gas. The fluid would be produced into a test tank, which would be disposed of at an approved disposal site off USFS and BLM lands. The gas then would be piped to an 80-foot-tall self-contained flare stack where it would be vented. The total amount of gas vented during testing would be limited by the conditions of approval set forth by the BLM. When testing is completed, the well either would be shut-in to await a pipeline connection, or reclaimed.

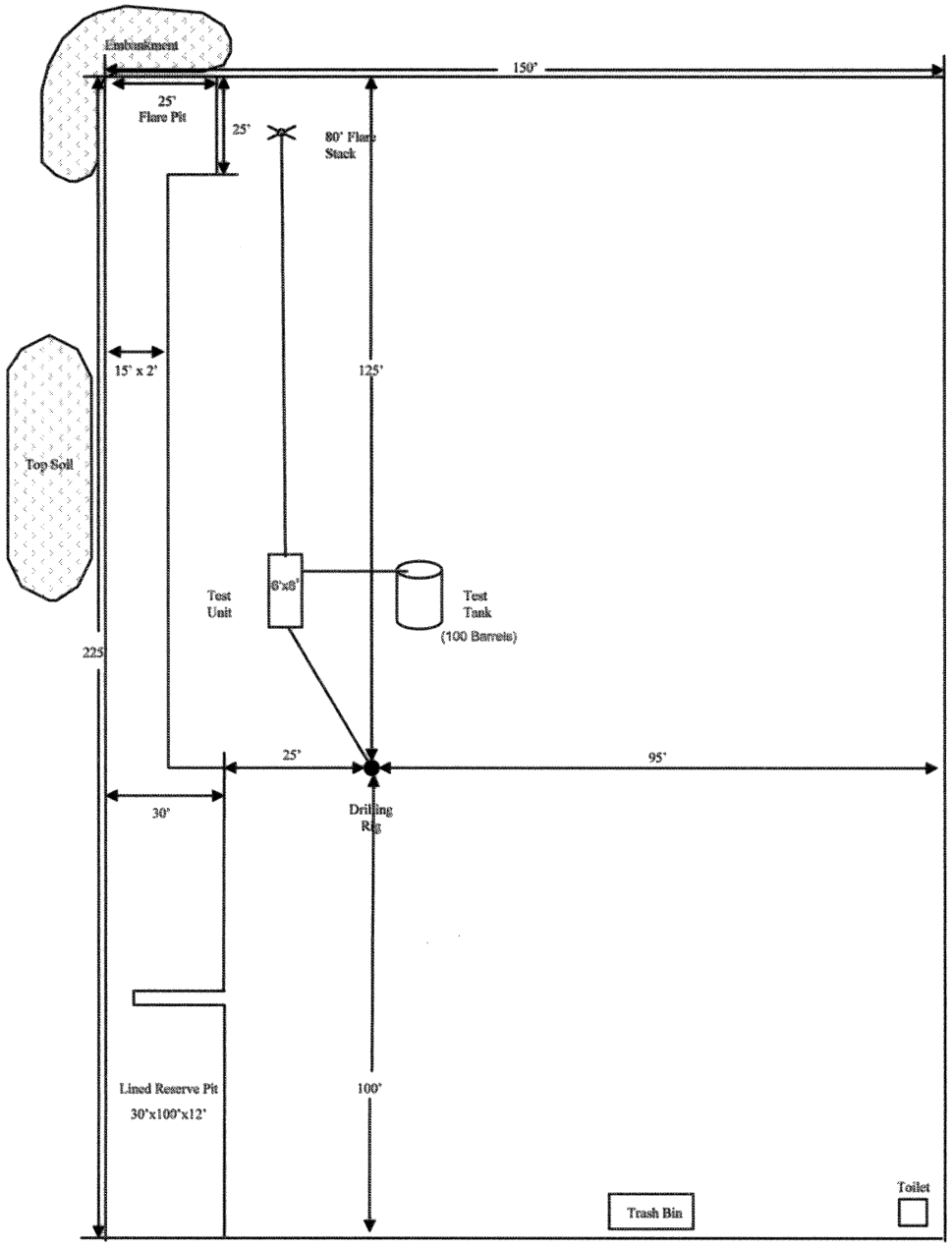
According to COGCC Rule 319b, a well may be shut-in or temporarily abandoned when completed, upon approval of the Director, for a period not to exceed 6 months provided the hole is cased or left in such a manner as to prevent migration of oil, gas, water or other substance from the formation or horizon in which it originally occurred. All shut-in or temporarily abandoned wells would be closed to the atmosphere with a packer or other approved method. The well sign would remain in place. If an operator requests shut-in or temporary abandonment status in excess of 6 months, the operator would state the reason for requesting such extension and state plans for future operation. A Sundry Notice, Form 4, or other form approved by the Director, shall be submitted annually stating the status of the well and plans for future operation. The Director would submit copies of any Sundry Notice, Form 4, to the local governmental designees.



Natural Gas Exploratory Drilling Project

Figure 2-7

Diagram of the Blooie Line Muffler



Total Acres = 0.77

Natural Gas Exploratory Drilling Project

Figure 2-8

Typical Well Test Layout

The BLM authorized officer makes decisions regarding well shut in (i.e., determines if the well may be used for beneficial purposes in the future or temporarily abandoned). The operator can request additional time to evaluate all the potentially productive zones behind the casing. If a well is determined by the BLM to be a "paying well," the well may be shut in to wait for pipeline connection. The following BLM regulations describe well abandonment procedures.

- The operator shall promptly plug and abandon, in accordance with a plan first approved in writing or prescribed by the authorized officer, each newly completed or recompleted well in which oil or gas is not encountered in paying quantities or which, after being completed as a producing well, is demonstrated to the satisfaction of the authorized officer to be no longer capable of producing oil or gas in paying quantities, unless the authorized officer shall approve the use of the well as a service well for injection to recover additional oil or gas or for subsurface disposal of produced water. In the case of a newly drilled or recompleted well, the approval to abandon may be written or oral with written confirmation.

- Completion of a well as plugged and abandoned also may include conditioning the well as water supply source for lease operations or for use by the surface owner or appropriate Government Agency, when authorized by the authorized officer.

- No well may be temporarily abandoned for more than 30 days without the prior approval of the authorized officer. The authorized officer may authorize a delay in the permanent abandonment of a well for a period of 12 months. When justified by the operator, the authorized officer may authorize additional delays, no one of which may exceed an additional 12 months. Upon the removal of drilling or producing equipment from the site of a well which is to be permanently abandoned, the surface of the lands disturbed in connection with the conduct of operations shall be reclaimed in accordance with a plan first approved or prescribed by the authorized officer.

For conventional gas reservoirs, cased-hole well testing would be conducted by first performing a small injection test to evaluate the permeability. If it is determined the zone of interest may be capable of economic production, it may be hydraulically stimulated. After being stimulated, the fluids and hydrocarbons would flow to the surface and be piped to the flare pit using a 7-inch Blooie line. The stimulation fluids would be recovered from the reservoir, and the well would be gauged to determine its productivity. Depending on the productivity of the well, flow tests can be conducted over several days or weeks. If the well does not test successfully while the completion rig is on location, the rig would be moved off, and the well would be shut-in (temporarily sealed, pending further evaluation). GEC would determine an alternative completion technique in an attempt to stimulate the well.

The coal seam reservoirs in the area of the South Flank of the Grand Mesa are expected to produce gas in a manner similar to a conventional sand reservoir. The coal seams would be tested as described in the section above. Data available from coal mine exploratory wells and gas wells drilled in the early 1980s suggest that the coals seams are relatively impermeable to groundwater movement. Due to the relatively low permeability, it is expected that large quantities of water would not have to be pumped to release gas from the coalbeds.

2.1.2.5 Water Use and Supply

Drilling operations would be responsible for most of the water consumed (mainly for cement) during the project. Water (about 0.1 acre-feet) would be used on the new spur roads for dust control. Water for drilling and completing the eight wells would be obtained from Oxbow's Elk Creek Mine (water decree case #97-CW 138 approved in December 1998), which is located near the town of Somerset, Colorado. The source of the water is the North Fork of the Gunnison River. The mine is located approximately 2 to 20 miles from the well pad sites. Water would be hauled by truck to the well locations over existing roads.

Water volumes used in the drilling operations are dependent upon whether the well is drilled using air or mud as the circulation medium, the depth of the well, and the losses that might occur during drilling. In addition, it is possible that approximately 25 percent of the used water could be recycled at each well for completion operations or for drilling another well. To estimate the quantity of water that may be used for drilling and completion operations, wells were divided into two categories: wells requiring intermediate casing or wells not requiring intermediate casing. Powerline, Bull Park, Leon Lake #4, and Leon Lake #5 would require intermediate casing, while Hubbard Creek, Oakbrush, Thompson Creek, and Hawksnest would not require this type of casing. The estimated range in total water use for all eight wells is between 1,128,000 to 1,792,000 gallons (3.4 to 5.4 acre-feet) without recycling. By recycling approximately 25 percent of the water, total water use could be reduced to approximately 846,000 to 1,344,000 gallons (2.6 to 4.1 acre-feet). The basis for the water use estimates is provided in **Table 2-4**. Water hauling for air drilling and completion would require approximately 50 to 70 truck trips (2-axle with 80-barrel tank) per well site. Approximately 24 additional truck trips would be required per well site for water hauling if mud drilling is used. Traffic numbers associated with water hauling are included in **Table 2-5**.

Table 2-4
Estimated Water Use (Gallons) for Drilling and Completion Operations

Water Use Category	Water Use Per Well	Water Use
No Recycling		
With intermediate casing (4 wells)	144,000 - 227,000	576,000 - 908,000
Without intermediate casing (4 wells)	138,000 - 221,000	552,000 - 884,000
Total 8 Wells		1,128,000 - 1,792,000
With 25 Percent Recycling		
With intermediate casing (4 wells)	108,000 - 170,000	432,000 - 681,000
Without intermediate casing (4 wells)	103,500 - 165,750	414,000 - 663,000
Total 8 Wells		846,000 - 1,344,000

2.1.2.6 Hazardous Materials and Emergency Response

Substances that are expected to be used for drilling, cementing, and completion activities and fuel use are listed in Appendix C, **Table C-1**. A file containing current Material Safety Data Sheets (MSDS) for all chemicals, compounds, and/or substances used during project activities would be maintained onsite.

Table 2-5
Estimated Traffic Requirements[1] for a Well Pad Site

Air Drilled					
Drilling Day	**Activity**	**Heavy Loads**	**Weight (lb)[2]**	**Light Loads**	**Total Loads**
1	Build location	1	75,000	2	3
2	Build location	1	75,000	2	3
3	Setup[3]	30	1,863,000	14	43
4	Drill	4	174,500	10	13
5	Run intermediate casing[3]	16	803,000	14	29
6	Drill	4	128,000	10	13
7	Drill	4	256,000	10	13
8	Drill, log	4	176,000	12	16
9	Cement casing[3]	30	1,860,000	20	49
10	Reclamation	2	185,000	2	5
Total Drilling		**96**	**5,595,500**	**96**	**192**
Completion Day	**Activity**	**Heavy Loads**	**Pounds**	**Light Loads**	**Total Loads**
1	Move frac tanks	2	60,000	2	4
2	Fill tanks[3]	20	1,090,000	2	22
3	Setup	14	704,000	10	24
4	Perforate and frac[3]	36	1,779,000	18	54
5	Flow well	0	0	8	8
6	Flow well	0	0	8	8
7	Flow well	0	0	8	8
8	Flow well	0	0	8	8
9	Install tubing and move	10	462,000	8	18
10	Reclamation	2	150,000	2	4
Total Completion		**88**	**4,195,000**	**76**	**158**

[1]The estimates above are on a per well basis. The completion rig would be moved to its first location after 2.5 wells have been drilled to stagger the heavy traffic days.

[2]Weight of vehicle and load.

[3]Includes water hauling. Approximately 24 additional truck trips per well site would be required if mud drilling is used.

GEC and its contractors would comply with all applicable federal laws and regulations involving hazardous materials. Hazardous materials would be located, handled, and stored in an appropriate manner that prevents the contamination of environmental resources. Any release of hazardous materials in excess of the reportable quantity as established by 40 CFR, Part 117, would be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. A Spill Prevention, Control, and Countermeasure (SPCC) Plan for a hazardous material spill or leak would be required by the federal agencies. The plan would include accidental discharge reporting procedures, spill response, and cleanup measures.

2.1.2.7 Water/Waste Disposal

Solid Waste

All solid wastes (trash) that result from the drilling operations would be contained in an expanded metal cage. The cage would be enclosed with fine mesh wire to contain any waste material. All material in the trash cage would be removed from the site and deposited in an approved sanitary landfill. Sewage disposal facilities would be used in accordance with the USFS, BLM, and Colorado regulations. Sewage disposal facilities would consist of chemical holding tanks and portable chemical toilets. Contents would be hauled to a commercial or municipal sewage treatment plant.

During air drilling solid waste in the form of drill cuttings would be produced as drill cuttings, which are circulated to the surface. If mud drilling is required, the solid waste would consist of drill cuttings and bentonite. The solids would be allowed to settle in the reserve pit and as much water as possible would be recovered for use on other wells. The remainder of the water would be allowed to evaporate and the solid materials buried in the reserve pit.

Hazardous Waste

No hazardous waste is expected to be generated as a result of project operations. If hazardous waste is produced due to a spill, the waste would be handled by a certified transporter and disposer to a Resource Conservation Recovery Act (RCRA)-approved offsite disposal facility. Disposal records would be prepared and maintained to ensure that no regulated waste would be left onsite or in reserve pits.

Produced Water

Formation water may be produced as a result of drilling and testing. The produced water would be held in tanks, tested, and removed to a certified disposal facility. The closest certified disposal facility is Black Mountain Disposal in Mesa County in Mesa, Colorado. The transport route is described in Section 2.1.2.9, **Table 2-6**. Produced water would be pumped into a tanking system and then siphoned to ponds for evaporation. At the Black Mesa facility, there are nine ponds ranging in size from 0.5 to 2 acres. It is not known at this time the quantity of water that could be produced during completion operations; however, it likely would range from 0 to 150 barrels per day (bpd) per well, declining to 30 bpd after 6 months. When the reserve pit is no longer required, water (if present) would be evaporated, and solid material (i.e., drill

cuttings) would be buried with reserve pit backfill at a minimum depth of 4 to 5 feet. Excess fluids, if present, would be contained onsite and removed to the Black Mesa facility.

Storm Water

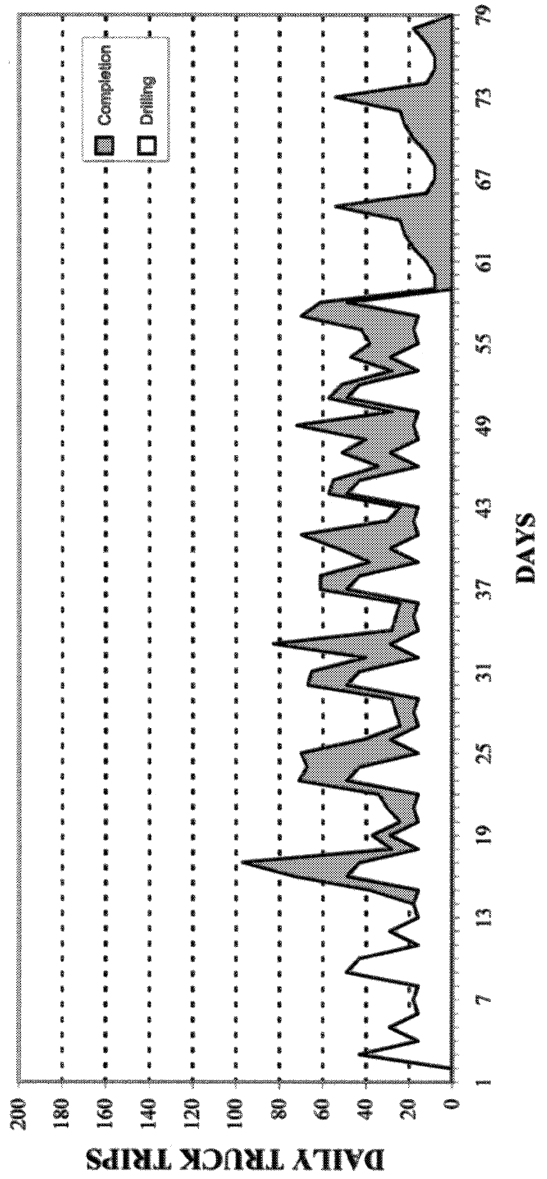
Procedures that would be used to control the discharge of pollutants in storm water runoff are described in Storm Water Pollution Prevention Plan (SWPPP). This plan would be submitted and approved by the USFS and BLM prior to any drilling or construction activity taking place. Storm water drainage from well construction sites would flow into swales constructed around the perimeter of the entire drilling site. Flow collected in the swales would then flow into the existing natural drainages. Sediment transport into defined drainages would be minimized through: 1) installation of drainage swales and certified weed-free hay bale check dams on the perimeter of the site, 2) permanent seeding of disturbed areas after completion of drilling activities, and 3) revegetation of the exposed soils at the end of construction.

2.1.2.8 Traffic Estimates

Estimated traffic requirements for construction, drilling, completion, and reclamation activities at each site are shown in **Table 2-5**. The number of trips should be considered general estimates. Approximately 4 to 7 round trips would be required during well pad and access road construction at each site. Well pad construction would be conducted during a 2- to 3-day period, which represents 1 round trip per day per site. Road construction would require 2 to 7 days depending on the length of the road. The approximate number of round trips for air drilling at each site would include 96 heavy-truck trips and 96 light-truck trips during drilling and 88 heavy-truck trips and 76 light-truck trips during completion. Approximately 24 additional truck trips per site would be required if mud drilling is used. It is anticipated that there rarely would be a time when all operations personnel would be simultaneously traveling to a particular well site. Drilling and completion traffic may vary over time in relation to weather and other factors. Air drilling operations would occur during a 20-day period, which represents approximately 17 trips per day per site. Reclamation would require 4 round trips per site.

Construction, drilling, and completion work would be accomplished by sequencing two crews per activity to two or three well pad sites. By using this approach, traffic numbers would be reduced in comparison to working simultaneously at all eight wells. The number of round trips per day would range from approximately 8 to 97 round trips per day when considering the drilling and completion activities for all 8 well pad sites during a 79-day period. The range in traffic numbers is shown in **Figure 2-9**. The average number of round trips per day would be 39. Based on a produced water quantity of 150 bpd per well, 4 truck trips per well per day may be needed to the Black Mesa facility during the post-completion phase. A 3-axle tanker truck would be used to haul produced water.

Testing and maintenance would require relatively low traffic levels. The estimated traffic for testing would be two round trips with light-duty trucks per day per well. Maintenance would require one round trip light-duty truck per month per well. If maintenance is required during the winter, 1 or 2 trips may be required using a snowmobile, ATV, skis, or snowshoes.



Natural Gas Exploratory Drilling Project

Figure 2-9
Traffic Estimates for the Eight Well Sites

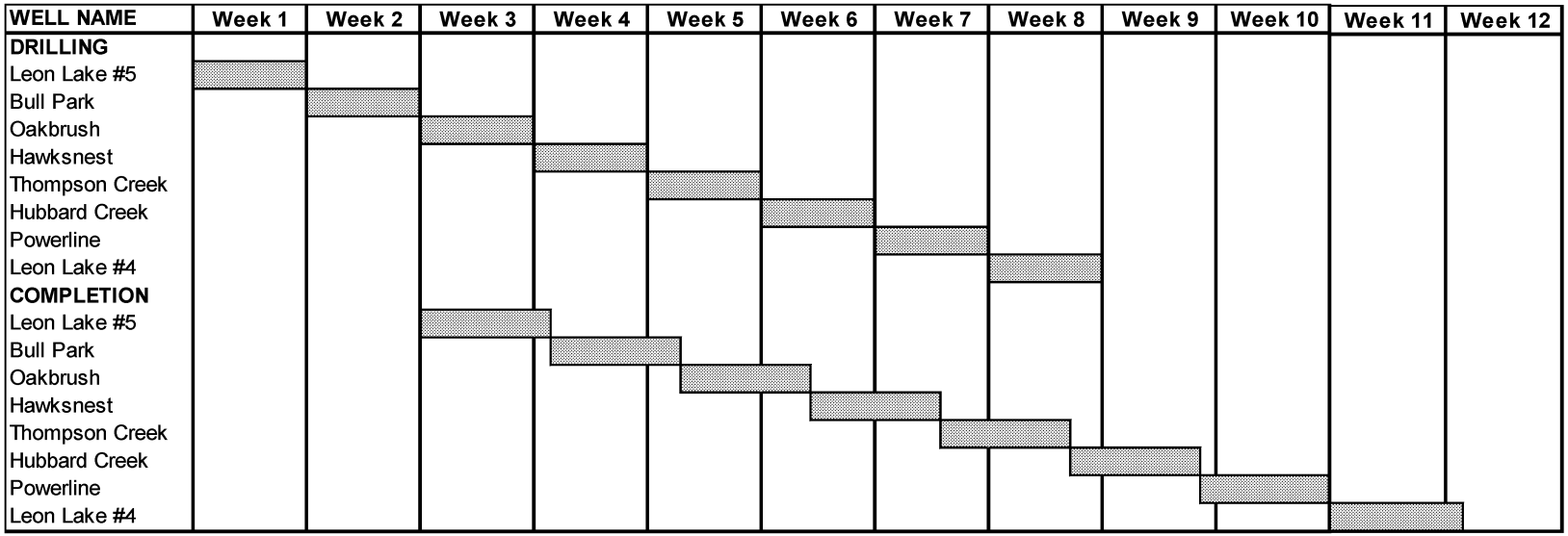
Traffic would occur on a combination of state, county, USFS, and BLM existing and newly constructed roads. Access routes for each site are listed in **Table 2-6**. Speed limits would be set by GEC through discussions with appropriate agencies or private land owners. They would be commensurate with road type, traffic volume, vehicle type, and site-specific conditions, as necessary, to ensure safe and efficient traffic flow. Signs would be placed along roads, as necessary, to identify speed limits, travel restrictions, and other traffic control information. The construction operator would schedule heavy traffic periods during the week and not on weekends or holidays.

2.1.2.9 Work Force Scheduling

One drilling rig and one completion rig would be used during the exploratory program. The completion rig would begin completing the first well after the drilling rig has completed the drilling of at least two wells. The sequence of drilling and completion activities is shown in **Figure 2-10**. The proposed project activities would be implemented over a 3-year period. Drilling and completion activities would require approximately 12 weeks for all eight well sites. Project activities are expected to be initiated in 2003 or spring 2004 depending on the timing of project approval, rig availability, and other such factors. If sufficient time is available, all eight wells could be constructed, drilled, and completed in year 1. Otherwise, these activities could be completed at some of the well sites in year 1, with the remaining activities finished in year 2. Testing could occur in years 2 and 3. The total number of workers at one time would range from 1 to 35 depending upon the exact cycle from drilling to completion activities. Testing would require 1 to 4 workers per site during years 2 and 3.

Table 2-6
Traffic Routes for the Natural Gas Exploratory Drilling Project

Well Sites	Routes
Leon Lake #4 and #5	Beginning in town of Cedaredge, travel north on SH 65 to CR U50 to DR 2500, then to FR 125 and FR 127, and connect to the new spur access road.
Powerline and Bull Park	Beginning at the intersection of SHs 133 and 187, travel north on Stephens Gulch Road (FR 701), then to WAPA maintenance road (Powerline site), and then connect to new spur access road.
Hubbard Creek and Oakbrush	Beginning at the town of Paonia, travel northeast on SH 133 to existing (BLM and then private) gravel resource road (Bear Creek Road), and connect to new spur access roads.
Thompson Creek and Hawksnest	Travel east on SH 133 past Somerset to an existing gravel road (Coal Gulch Road), and then connect to new spur access roads.
Produced Water Transport	**Route**
All sites	SH 92 to Delta and go north on SH 50 to Whitewater. Travel north on 32 Road to Interstate70 and go east to Debeque, turn right on travel 7 miles on 45.5 Road.



Note: Interim reclamation on wells to be economically productive would begin as soon as the wells are shut in for pipeline connection.
If sufficient time during the drilling season is available, all eight wells would be completed in year 1. Otherwise, a portion of the wells would be completed in years

2.1.2.10 Project Seasonal Use

All drilling, completion, workover and construction activities would be performed during the late spring, summer, and fall months (April through December). If an emergency arises during ongoing testing (e.g., malfunctioning or damaged equipment due to vandalism), it may be necessary to perform work in the winter months. Access would be made using snowmobile, skiing, or snowshoes. Work is proposed to be conducted during the hunting season.

2.1.2.11 Reclamation and Future Use

Reclamation would be required on all disturbed areas. The goals of interim and long-term reclamation are to return the land to existing use, stabilize the disturbed locations, and prevent noxious weed infestations.

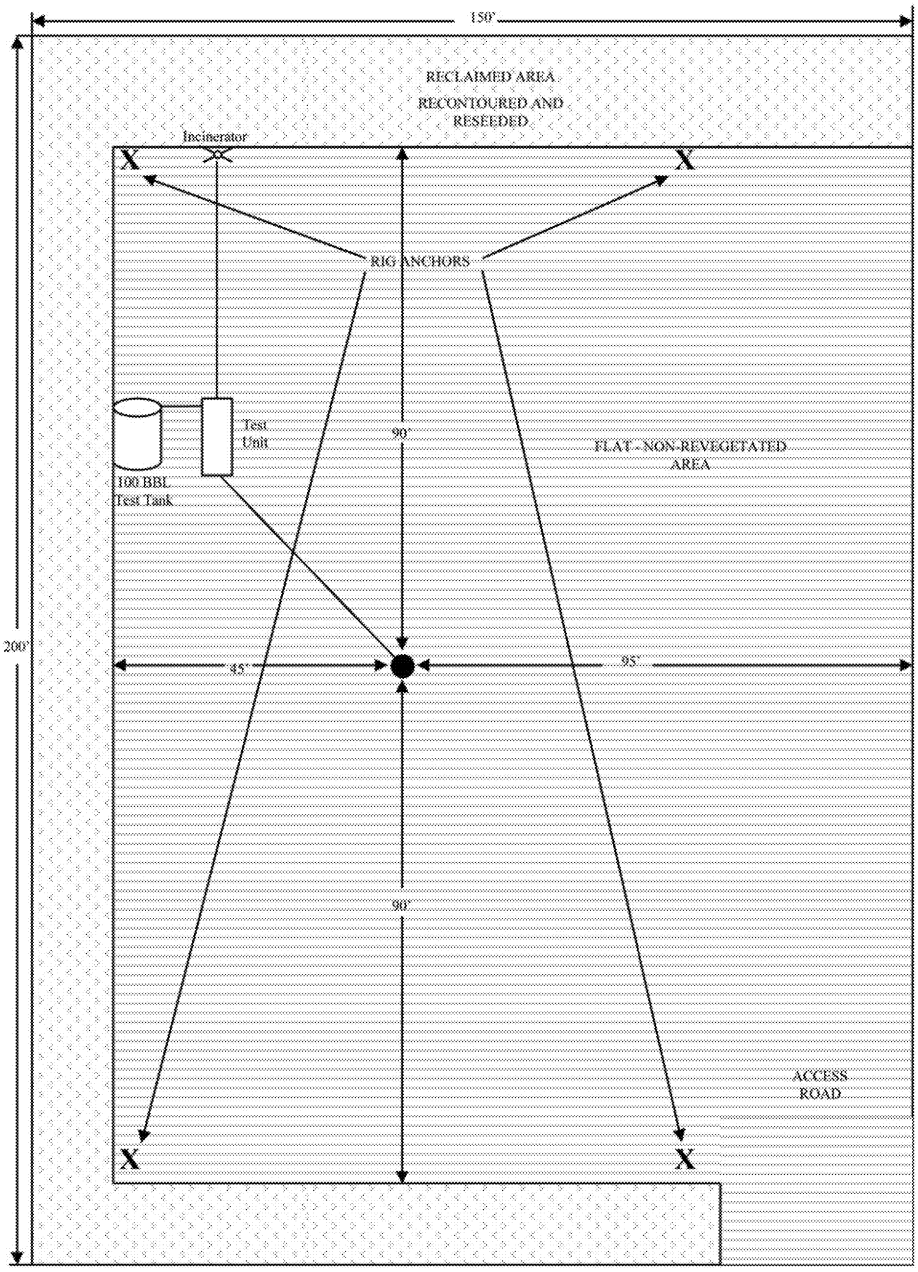
Depending on whether or not a well proves to be a producer dictates the extent and timing of reclamation activities. The following bullets discuss the timeframes and reclamation activities that could be expected, and **Figure 2-6** shows the decision points and timeframes.

- For well sites where drilling and/or testing data indicate that production is not viable, the well would be plugged and abandoned, reserve pits would be dried and filled, the pad location would be reclaimed, and any new access roads decommissioned as soon as possible after this determination is made. Site reclamation would include returning the entire pad location and access road to approximate original contour, and revegetated. Any decommissioned access roads would be blocked using rocks, slash, etc., to prohibit future vehicle use. In this case, the site would be disturbed for a 2- to 6-month period.

- For wells that are determined to be economically viable during initial testing, interim reclamation would occur after initial well testing is completed. The drill site would be reduced in size from 0.77 acre to 0.58 acre (**Figure 2-11**). The reclaimed portions would be revegetated, along with road berms along the access roads. This interim reclamation would be expected begin between 2 and 6 months after initial drilling and testing of the well.

- For wells that would be approved to be carried through to production, the drill site would be reduced to a "production pad" encompassing 0.24 acre. The portions of the reclaimed site would be recontoured to a stable configuration and reseeded. Berms along the access roads also would be seeded. The well site could be in this condition for 25 to 30 years. At the end of a well's productive life, final reclamation would be done. This would include returning the pad site and access road to approximate original contour, revegetating the sites, and blocking the access roads with slash, rock, etc.

General practices for reclamation would include backfilling, leveling, and recontouring would occur as soon as the reserve pit has dried. Stockpiled topsoil would be spread over the disturbed area and then reseeded using a certified grass seed mixture for aspen, oakbrush, wyethia (herbaceous forb), meadow, and mountain shrub vegetative zones (8,000 to 9,600 feet in elevation above mean sea level) according to the USFS and BLM species composition and application rates. Revegetation and reseeding would be conducted in the fall (September 15 until the first frost). The seedbed would be prepared by disking or ripping to a depth of 12 inches following the natural contour. Seed would be applied with a drill seeder at a



Total Acres = 0.58

Natural Gas Exploratory Drilling Project

Figure 2-11

Typical Well Pad Layout
After Partial Reclamation

depth of 0.5- to 1-inch soil cover. In areas where a drill seeder can not be used, broadcast seeding would be done at double the drill seeding rate. All soil work, seeding, and revegetation would be completed during the first fall planting season (September 15 through first frost) following disturbance. Site would be seeded with the following species. Application rates are for drill seeding; rates would be increased 50 percent for broadcast seeding. The proposed seed mix for USFS lands would be:

Mountain brome (*Bromus marginatus*) (4 pounds pure-live-seed [PLS] per acre)
Orchard grass (*Dactylis glomerata*) (2 pounds PLS per acre)
Pubescent wheatgrass (*Agropyron trichophorum*) (3 pounds PLS per acre)
Timothy (*Phleum pratense*) (2 pounds PLS per acre)
Arizona fescue (*Festuca arizonica*) (3 pounds PLS per acre)
Alsike clover (*Trifolium hybridum*) (1 pounds PLS per acre)

The following seed mix would be used for BLM lands at the Hawksnest and Thompson Creek sites.

Western wheatgrass var. Arribe (*Agropyron smithii* var. *Arribe*) (0.96 pound PLS per acre)
Slender wheatgrass var. San Luis (*Agropyron trachycaulum* var. *San Luis*) (0.66 pound PLS per acre)
Mountain brome (*Bromus marginatus*) (1.5 pounds PLS per acre)
Big bluegrass var. Sherman (*Poa ampla* var. *Sherman*) (0.18 pound PLS per acre)
Bottlebrush squirreltail (*Elymus elymoides*) (0.96 pound PLS per acre)
Canada wildrye (*Elymus canadensis*) (0.94 pound PLS per acre)
American vetch (*Vicia americana*) (0.60 pond PLS per acre)
Rocky Mountain penstemon (*Penstemon strictus*) (0.09 pound PLS per acre)
Western yarrow (*Achillea millefolium*) (0.06 pound PLS per acre)

2.1.2.12 Design Features of the Proposed Action

The following environmental protections are included as Design Features of the Proposed Action. These design features were derived from stipulations on the oil and gas leases, or were included as part of the SUPOs. The list below shows the design features by resource category, and indicate which lease or individual well site to which it applies. These design features are included in **Table 2-8**, along with an "effectiveness rating (ER)" for how well they would address impacts of the proposed activities. A discussion on lease stipulations follows.

The USFS and BLM identified stipulations that were added to each individual lease for protection of surface resources within the lease. The following discussion briefly describes the history of each lease, and where each individual well site falls with respect to specific stipulations. A summary of lease stipulations is given on **Table 2-7**. It is important to note that the stipulations may or may not affect all the lands in a particular lease. The following discussion details where individual wells sites fall with respect to lease stipulation(s). An example lease along with applicable stipulation maps from the leases are included in Appendix D.

Table 2-7
Lease Stipulations in Effect for Federal Oil and Gas Leases Related to the Proposed Project

Lease Numbers	COC-65117	COC-65529	COC-65534		COC-65535	COC-65537	C-13563A		Comments
Lease Stipulations/Well Site Names	**Hawksnest**	**Thompson Creek[1]**	**Hubbard Creek**	**Oakbrush**	**Powerline**	**Bull Park**	**Leon Lake #4**	**Leon Lake #5**	
No Surface Occupancy (NSO) allowed on lands defined as wetland, floodplain, or riparian area.			x	x	x	x			None.
CSU during the period December 1 to April 30 to protect big game winter range. New roads would be closed to the public year round.	x	X				x			Applies to Sections 35 and 36 in T12S and 90W; Sections 31 and 32 in T12S, T91W; and Sections 1, 2, 3, 5, 6, 10-12, T13S, R90W.
CSU occupancy would be required in big game winter range (limit road use to periods when animals are not present in winter range; reclaim access roads; and schedule maintenance activities to avoid December 1 to April 30 for big game species).		X				x			Applies to portions of Sections 35 and 36 in T12S and 90W and Sections 31 and 32 in T12S, T91W.
NSO allowed on lands identified as bald eagle winter concentration areas from December 1 to April 30.	x								Applies to Sections 10-12, T13S, R90W.
CSU for areas of moderate geologic hazards.			x	x	x	x			Special interdisciplinary team analysis and potential mitigation plans is required for surface occupancy or use in areas with moderate geologic hazards.
NSO in areas of high geologic hazards.			x	x					None.
CSU for areas with slopes from 40 to 60 percent.		X	x	x	x	x			Special interdisciplinary team analysis and potential mitigation plans would be required for surface occupancy or use in areas with slopes ranging from 40 to 60 percent.
NSO is allowed in areas with slopes exceeding 60 percent.			x	x	x	x			None.

Table 2-7 (Continued)

Lease Numbers	COC-65117	COC-65529	COC-65534		COC-65535	COC-65537	C-13563A		Comments
Lease Stipulations/Well Site Names	Hawksnest	Thompson Creek[1]	Hubbard Creek	Oakbrush	Powerline	Bull Park	Leon Lake #4	Leon Lake #5	
Activity must comply with the Roadless Area Conservation Rule (RACR).			x	x	x	x			Portions of these leases contain parts of IRA, which would be affected by the RACR. If implemented, the RACR would prohibit road construction and reconstruction in IRAs that overlap minerals leases issued after January 12, 2001. None of the proposed well sites are within the boundaries of an IRA.
Development must be managed to protect the economic recovery and safety of coal mining where the overburden is less than 3,500 feet.	x	x	x	x	x	x			Oil and gas development must allow maximum economic coal recovery and maintain safe underground mining operations.
NSO within 500 feet of the centerline of any and all roads and/or highways.							x	x	Exception would be evaluated for the Leon Lake #5 site, which is located approximately 330 feet from FR 127.
NSO within 200 feet on either side of the centerline of any and all trails.							x	x	None.
NSO within 500 feet of the normal highwater line of any lakes, ponds, and reservoirs.							x	x	Exception would be evaluated for the Leon Lake #4 site (located approximately 460 feet from the high-water line of an unnamed pond).
NSO within 500 feet of any and all streams.							x	x	Exception would be evaluated for the Leon Lake #5 (located approximately 97 feet from an intermittent stream).
NSO within 400 feet of any and all springs.							x	x	None.
NSO within 400 feet of any improvements either owned, permitted, leased or otherwise authorized by the USFS.							x	x	None.
NSO in T12S, R94W, Section 12, NW 1/4 (recreation site).							x	x	None.

[1]The Thompson Creek site is not located on a lease, and thus requires a ROW from the BLM. It targets potential gas held in Lease COC-65529, but proposes to drill from off-lease.

Lease COC-65117, Hawksnest Proposed Well

This lease has been in effect since 2001. The Hawksnest drill site is affected by timing limitations for bald eagle and elk/and deer crucial winter ranges.

Lease COC-65529, Target for Thompson Creek Proposed Well

This lease has been in effect since 2002. No surface disturbance has been proposed on this lease, but the Thompson Creek proposed well would target the gas resources contained in this lease. The proposed well was not located on lease because the lease is part of an IRA, on which proposed laws and USFS policies have placed certain prohibitions and restrictions on road building.

Lease COC-65534, Hubbard Creek and Oakbrush Proposed Wells

This lease has been in effect since 2002. The Hubbard Creek and Oakbrush sites are proposed in areas where a CSU[2] stipulation for moderate geologic hazards is in effect.

Lease COC-65535, Powerline Proposed Well

This lease has been in effect since 2002. The Powerline site is proposed in an area where a CSU for moderate geologic hazards is in effect.

Lease COC- 66537, Bull Park Proposed Well

This lease has been in effect since 2002. The Bull Park proposed well falls in an area that is covered by a CSU stipulation for moderate geologic hazards.

Lease C-13653-A, Leon Lake #4 and #5 Proposed Wells

This lease, which has been in effect since 1971, is part of the Leon Lake Unit (a combination of lease C-13563-A and C-13509). The Unit was formed in 1981, and has been held for production by the Leon Lake #2 well since then. The Leon Lake #4 falls in an NSO[3] area for being within 500 feet of lakes, reservoirs, and ponds (the location is 460 feet from an unnamed pond). The Leon Lake #5 falls within NSO area for being within 500 feet of an existing road (the location is 330 feet from FR 127), and falls in an NSO for being within 500 feet of streams (the location is 97 feet from an intermittent stream).

[2] Allowed use and occupancy (unless restricted by another stipulation) with identified resource values requiring special operational constraints that may modify the lease rights. Controlled Surface Unit is used as an operating guideline, not as a substitute for No Surface Occupancy or Timing stipulations.

[3] A fluid mineral leasing stipulation that prohibits occupancy or disturbance on all or part of the land surface to protect special values or uses. The No Surface Occupancy stipulation includes stipulations which may have been worded as "No Surface Use/Occupancy," "No Surface Disturbance," "Conditional NSO," and "Surface Disturbance or Surface Occupancy Restriction by location." Lessees may exploit the oil and gas or geothermal resources under leases restricted by this stipulation through use of directional drilling from sites outside the No Surface Occupancy area.

Leases COC-65117, 65529, 65534, 65535, and 65537 all contain a general stipulation acknowledging that the primary mineral resource for development is coal. BLM would resolve any of these resource conflicts should they arise.

All the leases involved with the project are on NFS lands, except COC-65117. The leases involving NFS lands also have the stipulation for lands of the NFS under the Jurisdiction of the USDA. This general stipulation requires the lessees to comply with laws and regulations governing the use of NFS lands, and has specific direction for cultural and paleontological resources, and TES.

Air Quality

1. Dust would be controlled using non-toxic and non-polluting materials (all sites).

Geology and Minerals

1. NSO (see Chapter 6.0) or use would be allowed in areas with high geologic hazards (lease COC-65534).

2. CSU (see Chapter 6.0) stipulations for moderate geologic hazards applies to leases COC-65534, 65535, and 65537.

3. Leases COC-65117, 65529, 65534, 65535, and 65537 are in the Paonia-Somerset Known Recoverable Coal Resource Area (KRCRA). Coal resource recovery is the primary mineral resource objective.

Soils

1. Leases COC-65534, 65537, and 65535 contain an NSO stipulation for slopes greater than 60 percent.

2. Leases COC-65534, 65535, and 65537 contain CSU stipulations for slopes ranging from 40 to 60 percent.

3. Soil erosion would be prevented by implementing procedures in the SWPPP and reclamation of disturbed areas (all sites). The SWPPP would be submitted to the USFS and BLM for approval prior to ground disturbance activities.

4. Surface disturbance would be restricted to approved locations. Construction equipment would be restricted to the road prism at all times.

5. Effects of potential spills or leaks at well sites would be minimized by implementing the SPCC Plan. This plan would be submitted to the USFS and BLM and approved prior to ground disturbance activities.

Water Resources

1. Lease C-13563-A contains a NSO stipulation for areas within 500 feet of the normal high water mark of any and all lakes, ponds, and reservoirs.

2. Lease C-13563-A contains a NSO stipulation for areas within 500 feet of the normal high water mark of any and all streams.

3. Lease C-13563-A contains a NSO stipulation for areas within 400 feet of springs.

4. Leases COC-65534, 65535, and 65537 contain a NSO stipulation for areas defined as a floodplain.

5. Erosion would be minimized by implementing procedures in the SWPPP, Grading and Surface Hydrology Plan, and reclamation of disturbed areas (all sites).

6. Effects of potential spills or leaks at well sites would be minimized by implementing the SPCC Plan.

7. The operator will perform initial water quality and quantity baseline testing for all water wells or springs for which surface owner access is granted within a 1-mile radius area prior to the proposed drilling operation. Baseline data on springs will include location coordinates and photo documentation in addition to quantity measurements and documentation of the method of quantity measurement, where possible. The initial water quality baseline testing shall include analyses for benzene, toluene, ethylbenzene, xylenes, methane, major cations and anions, total dissolved solids (TDS), iron, manganese, ammonia, pH, presence of bacteria, specific conductance, and hydrogen sulfide.

   Copies of all test results described above will be provided to the COGCC, the local county, the BLM, and the USFS within 3 months of collecting samples used for the test. If it is determined that the well will be a producing well, the operator will submit a plan for periodic monitoring of water wells and springs in the area.

Vegetation

1. Leases COC-65534, 65535, and 65537 (i.e., well sites) contain a NSO stipulation for areas defined as a wetland or riparian vegetation.

2. Road location and construction would be completed in a manner that would maintain the basic natural condition and character of riparian areas (all sites).

3. A Noxious Weed Management Plan would be implemented to prevent the spread of noxious weeds after construction activities. These measures would include special handling of vegetation and soils stripped from identified weed infestations, the use of certified weed-free mulch and certified weed-free straw bales to control erosion, and follow-up monitoring and treatment methods that would be implemented following construction (all sites).

4. Revegetation of all disturbed areas (all sites).

5. Fire prevention and control measures would be implemented during all activities.

Wildlife

1. Lease COC-65537 (Bull Park site) contains a CSU and timing stipulation for areas of big and small game (mule deer, elk, bighorn sheep, and turkey) winter range. Drilling activity is not allowed from December 1 through April 30, and road use for maintenance and operations are scheduled to minimize effects.

2. Lease COC-65117 contains a timing limitation stipulation for areas of crucial deer and elk winter ranges. Drilling activity is not allowed from December 1 to April 30.

3. Lease COC-65537 (Bull Park site) contains a timing stipulation for big and small game winter range that includes new roads would be closed year-long to the public.

4. Effects of potential spills or leaks at well sites would be minimized by implementing the SPCC Plan.

5. Northern goshawk and other raptor nest surveys, as well as purple martin and other potential USFS and BLM sensitive breeding bird nest surveys, would be conducted during the breeding period (mid-May through June) in areas of potentially suitable habitat within a 0.25-mile radius of the proposed disturbance areas.

Threatened and Endangered Species

1. Prior to any surface disturbance activities, effects to TES will be completed by a qualified resource specialist for federally listed species and their habitat or species proposed for listing as threatened and endangered as required under the Endangered Species Act (ESA) (all sites).

2. Lease COC-65117 contains a timing limitation stipulation for bald eagle winter concentration areas along the North Fork of the Gunnison River. Drilling activity is not allowed from December 1 to April 30.

3. See design feature #5 under wildlife relative to sensitive raptor and passerine species nest surveys.

Visual Resources

1. All facility structures would use colors to blend in with the surrounding landscape. Paint color should have a flat, non-reflective finish (all sites).

Cultural and Paleontological Resources

1. The operator would notify the USFS or BLM if any cultural or paleontological resources were discovered during surface disturbance activities. The discoveries would be left intact until the permission to proceed is given by the USFS or BLM (all sites).

Land Use and Recreation

1. NSO would occur within 200 feet of the centerline of trails (lease C-13563A, Leon Lake #4 and #5).

2. NSO would occur within 400 feet of any improvements either owned, permitted, leased, or authorized by the USFS (lease C-13563A).

3. The existing Coal Gulch/Pilot Knob ATV trail will be rerouted around the west side of the Thompson Creek until such time that it can be returned to its original location.

Transportation

1. NSO would occur within 500 feet on either side of the centerline of any and all roads and/or highways (lease C-13563A).

2. Portions of leases COC-65529, 65534, 65535, and 65537 overlap with IRAs as such activities would be affected by the USFS RACR and Interim Directive, 1920.

3. All newly constructed roads would be closed to motorized public use.

4. Vehicular traffic would be restricted to approved locations. Construction equipment would be restricted to the road prism at all times.

5. No mud blading would be allowed on the access roads.

6. Movement of heavy equipment would be scheduled during the week to avoid high public traffic periods. Drilling equipment would not be moved during spring breakup (all sites).

7. The construction operator would schedule heavy traffic periods during the week and not on weekends or holidays.

2.2 Public Involvement

The USFS and BLM conducted a public scoping effort to solicit input on the proposed project. The scoping period began December 30, 2002, and ended January 31, 2003. The scoping process included the following components:

2.2.1 Scoping Notification

A legal notice of the scoping period appeared in the *Grand Junction Daily Sentinel* on December 28, 29, and 30, 2002.

News releases appeared in the *Delta County Independent* and the *Grand Junction Daily Sentinel* on January 8, 2003.

A scoping letter, including a project map, was mailed to approximately 950 addressees on USFS/BLM mailing lists. The scoping letter was dated December 30, 2002.

2.2.2 Scoping Open House

The USFS and BLM held a public Open House at Heritage Hall in Hotchkiss, Colorado, on January 22, 2003, from 4:00 to 7:00pm. The objectives of the meeting were to provide information to the public regarding the proposed project and to solicit public input. A total of 38 people signed the attendance record for the scoping meeting.

The scoping Open House was announced on public radio station KVNF, which broadcasts from Paonia, Colorado, and was advertised in the *Delta County Independent*.

2.2.2.1 Summary of Scoping

A total of 279 comment letters were received during the public scoping period. The public submitted written comments at the open house and by mail and e-mail. In addition, several parties submitted verbal comments via telephone. The scoping comments are summarized in Sections 2.3 and 2.4 below.

2.2.2.2 Schedule of Proposed Actions

The project also is included in the GMUG schedule of proposed actions (SOPA). The SOPA is mailed to about 300 individuals on a quarterly basis. It also is available via the GMUG web site.

2.2.3 Project Web Site

The USFS and BLM established a project Internet web site (http://extranet.ensr.com/gec_gasex_ea/) which is updated approximately monthly. The web site includes:

- Project summary and map;
- NEPA process;
- Public participation opportunities;
- Scoping summary;

- Status of EA preparation;
- Agency contacts for the EA; and
- Memorandum of Understanding between the project Proponent, USFS, and BLM for a primary consultant to prepare the EA.

2.3 Issues Carried Forward in Analysis

Operations and Gas Resources

- This is a coalbed methane (CBM) project and not conventional natural gas.
- Concern with exploratory well density, e.g., Leon Lake #2, #4, and #5.
- Indicate geologic basis and criteria for well site locations.
- Proper fracing and design must be used.
- Need for proper cementing and casing.
- Need to test formations near wellbore.
- Explain vast differences between CBM and conventional gas wells.
- Conventional wells are devoid of water and flow under own pressure.
- Disclose the amount and types (benzene, toluene, ethylbenzene, xylene, polycyclic aromatic hydrocarbons, methanol, naphthalene, sodium hydroxide, methyl tertiary-butyl ether, ethylene glycol, monobutyl ether) of fracing fluids to be used.

Air Quality

- Impairment of air quality, including ozone levels, volatile organic compounds, fugitive dust from truck traffic on roads, and emissions from vehicles and flaring, and other onsite operations.
- Effects of diesel generator emissions.
- Release of chemicals that create ground-level ozone and greenhouse gases.
- Effects of methane leaks.

- Hazardous air pollutant emissions.
- Odors produced by drilling operations.
- Identify proposed dust abatement measures.
- Effects of air quality changes on the West Elk and Raggeds Wilderness areas.
- Effects of airborne silica.
- Potential air quality-related effects on organic orchards.

Soils

- Increased erosion potential.
- Potential soil contamination due to leak or spill of saline water, hydrofracturing chemicals, fuels, and lubricants.
- Effects of proposed activities on slope stability.

Geology and Minerals

- Drilling will allow opportunity to gather gas and groundwater data.
- Risk of hydrofracing to interconnect strata.
- Drilling effects on fault lines and indirect effects on aquifer water quantity and quality.
- Hydrofracturing effects on seismic activity and associated effects on water storage systems.
- Hydrofracturing effects on Surface Creek fault.
- Risk for landslides, earthquakes, and subsidence induced by groundwater withdrawal.
- Effects of gas seeping out of outcrops.

Surface Water

- Adequacy of baseline surface water information and need for pre-activity water testing.
- Drilling and hydrofracturing effects on surface water quantity and quality.

- Drilling and hydrofracturing effects on domestic water supplies, including domestic water wells and municipal supplies (Town of Cedaredge, Upper Surface Creek Water Users Association, Pitkin Mesa Pipeline, and Sunshine Mesa Water Company).

- Drilling and hydrofracing effects on irrigation water supplies (Terror Ditch, Overland Ditch, and Leroux Creek).

- Drilling and hydrofracing effects on water rights, and how will damaged water rights be replaced.

- Drilling and hydrofracing effects on stock water sources on federal and adjacent private lands.

- Effects of produced water (salinity and selenium) on surface water quality.

- Effects of spills or overflows of containment ponds on surface water quality.

- Spill effects of transferring produced water to waste disposal site in the Upper Colorado River Basin.

- Sedimentation effects from construction and vehicle traffic on surface water quality and potential of proposed activities to increase sedimentation to surface water drainages.

- Ensure monitoring of surface water quantity and quality in potentially affected areas.

- Surface water quality effects of fertilizer use during reclamation.

- Effects of vegetation removal on runoff characteristics, potential sedimentation to surface drainages.

- Potential for proposed activities to create water depletion in Colorado River basin.

- Cumulative effects of proposed activities on water resources in light of current drought.

Groundwater

- Adequacy of baseline groundwater information, and need for pre-activity water testing.

- Potential effects of drilling, including water injection on groundwater quantity and quality, and aquifer depletion.

- Increased metal (including selenium) and salinity levels in groundwater.

- Effects of drilling and hydrofracturing on groundwater quality and quantity.

- Effects of drilling and hydrofracturing on wells used for domestic, commercial, and agricultural purposes.

- Effects of drilling on springs (water quality and quantity).
- Effects of fertilizer use on groundwater quality during reclamation (i.e., nitrate and phosphate increases in wells).
- Effects on groundwater basin translocation.
- Effects on groundwater recharge, including coalbeds that are in recharge area.
- Potential for gas to migrate through coalbeds that are recharging creeks.
- Effects to groundwater rights and how will damaged water rights be replaced.
- Define if the groundwater is tributary or non-tributary.
- Cumulative effects of proposed activities on water resources in light of current drought.
- Disclose amounts of produced water, toxicity, and how it will be disposed.

Vegetation/Range

- Effects on wetland quantity and quality.
- Effects on riparian areas due to increased selenium.
- Effects to forest vegetation.
- Increased risk of fire effects to vegetation.
- Potential for spread of noxious weeds, including potential for weeds to be introduced through use of contaminated road base materials.
- Air quality effects to vegetation.
- Effects of release of hydrofracturing chemicals or saline water from reserve pits on vegetation.
- Effect on agricultural productivity.
- Effects on cattle grazing, stock water sources (including fencing stock ponds), and open range.
- Effects on fencing, range allotments, and grazing permits.
- Traffic effects on cattle along access roads.